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ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION.

0 - **The Agricultural Wealth of the New Hebrides.** — LARGEAU, T. (President of the French Agricultural Syndicate of the New-Hebrides), in the *Revue agricole, Organe de la Chambre d'Agriculture de la Nouvelle Calédonie*, No. 54, pp. 31-52. Noumea, 1917.

The chief crops of the New Hebrides are *coffee, cacao, copra, cotton* and *aize*. Under present conditions these are the only remunerative ones. *ola. vanilla, pepper, spices* of all kinds, *manioc*, the most varied *textiles, rice, rghum, banana*, etc., yield as good crops as elsewhere, but the quality of e labour and economic reasons, do not, for the moment, allow these be grown advantageously.

This, however, does not apply to *coffee* of which the hardy species re-ntly imported from the Congo through the Botanical Garden of Java. ve great promise.

Cacao, of which large plantations were formed when hemileia made s appearance in 1913, has given remarkable results. The cacao of the New ebrides is in no way inferior in theobromine and butter content to any of ie best varieties on the European markets.

For the moment *copra* holds the first place in commercial value among ie products sent from the New Hebrides.

Cotton gives excellent results both in quality and yield, but growers em to be taking less and less interest in this crop which requires much bour for picking. Certain estates which were under favourable conditions this respect have made very large profits.

Maize, although satisfactory, will never be grown to any but a limited dent on account of heavy freight and the few markets available.

Sandal-wood grows wild in certain parts of the islands. For four years has been subjected to intensive cutting, which, in view of the impossi-

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bility of regulation, shows it will be ruined before long. There are other valuable woods which are not exploited owing to lack of labour and capital.

The following table shows the comparative value of the agricultural products exported from the New Hebrides from 1914-1916.

	1914		1915		1916	
	lbs.	£. s. d.	lbs.	£. s. d.	lbs.	£. s. d.
Cocao	97 231	3107.17. 5	173 052	5621. 8. 2	9 504 774	19063.17. 5
Coffee	331 811	10742. 5.10	833 851	26994. 4. 7	3 594 079	19231. 8. 5
Copra	7 349 185	66085.10. 8	9 017 252	81082.13.11	3 184 332	82600. 8. 3
Cotton	1 524 036	13704. 4. 3	3 486 131	31347.17. 5	862 302	34736. 7.10
Maize	1 025 235	22593.11. 9	3 333 965	8994. 8. 4	412 756	7582. 8. 9
Sandal-wood	225 869	2813. 9.10	230 339	3091 790		4345.10 2
Total.	—	119076.14.11	—	157032. 8. 5	—	167554. 1. 1

Almost all the exports rise from year to year, and there will be a considerable increase in 1917.

It should be noted that all these results were obtained in spite of the lack of agricultural instruction, with most primitive tools and without the aid of agriculturists and chemists as is the case in other countries. Under present conditions, if there is sufficient labour, it may be estimated that, in 1920, the products will amount to: — 1 500 metric tons of cacao, 6 000 of copra, 1 000 of coffee, 3 000 of cotton and 2 000 of maize, without counting other produce, such as shells and costly woods.

251 – ***Gambusia affinis*, a Small Fish Very Useful for the Destruction of Mosquito Larvae.** — RAVERET-WATTEL, C., in the *Bulletin de la Société Nationale d'Acclimatation de France*, Year LXIV, No. 12, pp. 445-451. Paris, December, 1917.

Gambusia affinis Baird and Girard is a very small fish (the largest specimens rarely attain a length of 5 cm.) belonging to the family Cyprinodontidae, which closely resemble Cyprinidae in outward appearance, but are differentiated by several characters, notably the presence of teeth; many of them are ovoviviparous, as is the genus *Gambusia* (1).

The Gambusias are of no value as food, but are of great utility as their food consists almost wholely in mosquito larvae, of which they destroy great numbers. They are the best fish as destroyers of mosquitoes as they live at the surface of the water (whence the name of " top minnows ", given in the United States) and they can live in water so shallow as to be uninhabitable for other species ; large numbers of this fish are often found in ponds where the mud is, at times, only covered by 3 cm. of water.

The fish breed easily, on account of their hardiness and the fact that as they are born in an advanced state of development, they are less exposed to various dangers. Experiments made in New Jersey have shown that not only are they easy to breed, but they constitute a hitherto neglected means for controlling mosquitoes wherever the water is sufficiently warm

(1) The name of *Gambusia* is derived from " Gambusina ", a Cuban word meaning a very small or worthless object. (*Author*).

2 - **The Digestibility of the Dasheen.** — LANGWORTHY, C. F. and HOLMES, A. D., in *U. S. Department of Agriculture, Bulletin* No. 612, pp. 11. Washington, November 8, 1917.

The dasheen and other varieties of the taro (*Colocasia esculenta*) was ll recently very little known in the United States, but of late the Depart- ent of Agriculture has given much attention to the selection of varieties ited to warm districts where the potato does not do well.

The edible part consists of a large central root, which may weigh from to 5 lbs., or even more, and by numerous small tubers about the size of rect potatoes. The dasheen may be cooked in several ways, like the potato, id has a pleasant flavour. As the literature on the subject gives no informa- on on the digestibility of this food, the Department of Agriculture car- ed out feeding experiments on strong, healthy men on a simple, but mixed et. The results were : —

Digestibility of the Dasheen.

	Protein	Fat	Carbo-hydrates	Ash
ripe roots and tubers (average of 6 experiments)	79.9 %	96.2 %	97.5 %	79.4 %
percoots and tubers (average of 10 experiments)	80.8	96.1	97.6 %	78.4

The average amount of food eaten daily per subject in all the experi- ents was 1733.4 gm., giving 1313.6 gm. of water, 41.2 gm. of protein, 9.4 gm. of fat, 230.6 gm. of carbohydrates and 18.6 gm. of ash. The nount of dasheen eaten per man per day varied from 376 gm. to 731 gm. ith an average of 547 gm. In no case did such large quantities of sheen cause physiological disturbances. The results show that the carbo- drates of dasheen, which form one of its principal constituents, have a gestibility which may be compared with that of the potato (99.0 % accord- g to BRYANT and MILLER, 92.4 % according to RUBNER, 99.6 % accord- g to COSTANTINIDI). There is no perceptible difference between the digesti- lity of ripe and unripe dasheen. In conclusion, it may be said that da- een forms an excellent food.

3 - **Hygienic Disadvantages of Using Lime in Breadmaking.** — See No. 344 of this *Review*.

4 - **Studies and Investigations of the Imperial Institute, London** (1). — *Bulletin of the Imperial Institute*, Vol. XV, No. 2, pp. 177-184, 198-270. London, April-June, 1917. EXPERIMENT AND ANALYTICA WORK

PRODUCTION AND USES OF RICE. — An article on the cultivation and eparation of rice was published in previous numbers of the *Bulletin of the perial Institute* (Vol. XI, p. 634, 1913; Vol. XII, p. 85, 1914), in which e varieties of rice, methods of cultivation and preparation, pests and di- ases, were described and an account given of the production of this cereal the British Empire. The article under review deals with the production

(1) See also *R.* January, 1918, No. 5. (*Ed.*)

and commercial movement of rice, especially in the British Empire, and the use of rice and its derivatives.

The production of rice, as shown by official estimates, for nearly all the rice-growing countries is given in the appended table. The chief omission is China, for which figures are not available.

World's production of rice.

Country	Production (cleaned rice) tons	Country	Production (cleaned rice) tons
India *		Bokhara and Khiva **	40 000
British India (1916-17)	31 079 000	Persia *	250 000
Native States	1 000 000	Mesopotamia *	30 000
Ceylon ** (1915)	172 000	Siam *	2 500 000
Malaya **		Dutch East Indies **	
Straits Settlements	35 000	Java and Madura (1914)	3 494 000
Federated Malay States (1913)	46 000	Sumatra, etc.	750 000
Kelantan	35 000	French Indo-China *	3 500 000
Perlis	7 000	Japan (1916)	8 177 000
British North Borneo ** (1914-15)	9 800	Korea * (1916)	1 758 000
Hong Kong **	15 000	Formosa * (1914)	647 000
Fiji **	9 000	Philippines ** (1915)	491 000
Egypt ** (1914-15)	366 000	Madagascar *	450 000
Uganda **	100	United States ** (1916)	520 600
Nyasaland (1916)	1 300	Mexico ** (1911)	15 000
British Guiana * (1915)	41 000	Guatemala ** (1916)	750
Trinidad **	1 700	Dutch Guiana ** (1914)	3 000
Italy * (1916)	320 000	Ecuador ** (1917)	15 000
Spain * (1916)	149 000	Peru ** (1915-16)	40 000
Bulgaria ** (1912)	3 000	Brazil *	250 000
Greece **	1 200	Argentina ** (1916)	7 000
European Russia ** (1913)	256		
Transcaucasia and Russian Turkestan ** (1911)	170 000	*Approximate World's total* (for countries listed)	59 401 000

* Exporting countries, in which production exceeds consumption.

**Importing countries, in which consumption exceeds production. It is doubtful which category the countries without any mark belong.

TAPIOCA STARCH FROM RHODESIA. — Cassava or manioc (*Manihot utilissima*), from the roots of which tapioca and tapioca starch are prepared, has been grown for several years at the Agricultural Experiment Station, Salisbury, Rhodesia. The plant does very well there. The root when fed to stock produced no ill effect. Some of the starch, prepared experimentally at Salisbury was sent to the Imperial Institute to be examined; it gave the following analysis: —

Moisture 14.4 %; proteins 0.1 %; fat 0.15 %; starch 82.8 %; ash 0.2 %; fibre and matter soluble in water, nil.

A firm of importers stated it to be of good quality and valued it at £ 28 per ton, ex quay Liverpool. Another firm considered it of medium quality and valued it at £ 20 to £ 25 per ton, delivered in Dundee.

THE LIME FRUIT IN NIGERIA. — The lime tree (*Citrus medica* var. *acida*) curs in most parts of British West Africa, and in some places has become turalised. The fruit is used to some extent locally for the preparation lime juice, but there is no export trade in either the fruit or its oducts.

The possibility of utilising the fruit has been investigated by the Govern-nt Chemist at Lagos, who sent to the Imperial Institute for examination sh fruit, distilled oil of limes, and a sample of citrate of lime. The fruit s found rather small (1 3/8 to 1 5/8 inches in diameter), but sound and good quality. There is a very small demand for them on the English rket. Analysis showed them to contain : —

Percentage of juice to fruit	57.4
Total solids in juice	10.6 gm. per 100 cc.
Citric acid in juice	8.2 gm. per 100 cc.
Purity of juice (ratio of acid to total solids) . .	77.0
Percentage of citric acid in entire fruit	4.4

To prepare the oil with the ripe fruit, the juice, skin and pulp are di-lled in steam separately and the distillates mixed. The average yield is 0.17 % of the whole fruit. The oil, of a pleasant odour and good ality, was similar in character to the Italian oil distilled from *Citrus metta* : —

Specific gravity at 15° C., 0.8946 ; optical rotation at 20° C., + 34°4' ; refractive index 21° C., 1.4815.

The citrate of lime was prepared from the concentrated lime-juice in e ordinary way. The yield of juice varied from 6 to 7 fluid oz. per lb. fruit, and the yield of citrate from 0.55 to 0.6 oz. per lb. of fruit. The sam-e examined contained : —

Moisture 4.9 % ; citric acid 70.6 % ; calcium carbonate 1 %.

It was stated to be of excellent quality and certain of a ready sale.

PISTACHIO NUTS AND THEIR CULTIVATION. — The pistachio tree (*Pi-cia vera*, Linn.) a native of Syria and Persia, is cultivated throughout e sub-tropical Mediterranean region, as well as in the Caucasus and in veral parts of western Asia. Its climatic requirements are similar to ose of the olive. In its original habitat it may occur at altitudes of 3 000 et. It prefers light soil, but will grow well in any that is not too damp. is resistant to wind and can withstand a few degrees of frost in winter, it requires a high summer temperature in order to fruit plentifully. It is mmonly held to yield a good harvest only in alternate years. It gives e best results in Tunis, and especially in Sicily, where, in view of the pidity of its growth, it might be much more widely cultivated than it is. may be propagated by sowing, grafting or budding. Budding is the ost common method, as by this means the tree may bear fruit after 2 or years. Plants grown from seed only bear fruit after 6 or 8 years, and, the tree is a dioecious Anacardiaceae, it is impossible to foresee whether will be productive (female). About 1/10 of the plants are male. Grafting carried out on other species of *Pistacia*, giving more resistant trees which

do well where *P. vera* from seed would not succeed ; thus, grafted on *P. Terebinthus* (grown from seed), it will give plants that will bear fruit in Central France. Once established, the pistachio needs little attention but fertilisation must be assured. As a rule one male tree is required to every 4 or 6 female trees, and the distance between a male and female tree should not exceed 20 yards. A male graft may be grown on a female tree or buds from both kinds of trees inserted in the same stock.

It is probable that the cultivation of the pistachio could be considerably extended. It grows readily in Cyprus, where it is commonly budded or grafted on *P. Terebinthus* and *P. Lentiscus* but does not produce well owing to the scarcity of male plants. In the East the fact that the plant is dioecious is not sufficiently appreciated. The tree could probably be grown in India, and its cultivation might be successful in the southern hemisphere, for instance in Australia and South Africa.

Pistachio nuts are an important article of commerce ; the imports into France (mainly from Russia and Turkey) in 1913, were 4 280 cwt., and the exports were 3 517 cwt., 1 982 of which went to the United States the total value being £ 42 888. The composition of the kernel is : —

Water 7.4 % ; crude proteins 22.7 % ; fat 51.1 % ; carbohydrates 13.0 % ; cellulose 2.5 %, ash 3.3 % ; food units 197.5.

The oil extracted from the kernels has the following constants: —

Specific gravity at 15° C. 0.9185 ; saponification value 191.0-191.6 ; iodine value 86.3-87.8 % ; solidifying point of fatty acids 13-14° C.

WAX FROM *Ceroxylon andicolum*. — This palm occurs only in western tropical South America, where it is very abundant. The wax, obtained from the leaves, is used in Colombia for making candles, but has not yet been exported. A sample of fine powdered wax of a pale straw colour examined at the Imperial Institute, and the wax obtained after purification, showed the following composition and characters : —

Moisture 1.5 % ; ash 0.6 % ; wax 92.0 % ; dirt (matter insoluble in carbon tetrachloride) 6.5 % ; specific gravity at 15° C. 1.018 ; acid value 19.8 ; saponification value 73.7 - 104.4 ; iodine value 32.8 % ; melting point (open tube method) 93° C.

The purified wax is similar in character to carnauba wax (*Copernicia cerifera*), which is obtained chiefly from Brazil, and the candelilla wax (*Euphorbia* sp.), imported from Mexico, but has a higher melting point (that of the two others is 84° C. and 70-72°C. respectively). It would be readily saleable at about the same price as these two waxes, which before the war, fetched from £ 5 to £ 9 per cwt. in the United Kingdom.

The wax must be purified before export. The following method is recommended by the Imperial Institute. The crude wax-dust is placed in a canvas or calico bag and immersed in boiling water, the bag being weighted to keep it below the surface. The melted wax rises to the surface, where it is allowed to cool. When cold, the wax is powdered and dried. It is then melted at a gentle heat (not more than 110° C. and not longer than necessary), allowed to solidify and the lower dark layer cut away, and either sold separately or repurified with the next batch.

255 - **Electrical Stimulation of Crops.** — BIRKS, L. and DAVIS, O' D., in *The Journal of Agriculture, New Zealand Department of Agriculture, Industries and Commerce*, Vol. XV, No. 4, pp. 185-190, 2 figs. Wellington, October, 1917.

New Zealand possesses large supplies of hydro-electric power and is in a particularly favourable position to apply this power to cultivation. Preliminary experiments have been made at Christchurch. The first was carried out in a greenhouse 80 feet × 30 feet in which 1 400 tomato-plants were set out. The house was fitted with lamps, hung 2 feet from the ground, which were kept alight from 9 p. m. till 5 a. m. As the plants grew the lamps were raised, until they were finally covered by the tops of the plants. At the beginning of the experiments the steam-pipes had gone out of order and many plants had been injured by a severe frost before the heating apparatus could be repaired. The plants recovered rapidly and gave a very heavy crop, ripening relatively earlier than those of another glasshouse, where the plants, which were not attacked by frost, were grown under similar conditions but without lighting at night.

A second experiment was carried out to test the possibility of protecting fruit trees against frost by means of 250-watt radiator lamps suspended in the centre of the tree, near the fork, and turned on during the nights when frost was to be feared. Three rows of 8 trees each were used for the experiment, one of pear-trees and two of mixed apples. The radius of action of the heat of the lamp was found to be approximately 1 ft. below the lamp, 4 ft. above it, and 3 ft. all round it horizontally. There were many frosts, two of which were very severe. Electric heating did not appear to have any effect on the pear-trees, but the apple-trees gave a heavier crop and ripened fully a fortnight earlier than those which were not heated by electricity.

The cost of installing electricity for stimulating crops in glasshouses is not prohibitive, working out at about 10 to 20 % of the actual present capital and interest and depreciation cost of the glasshouse. The use of electricity for stimulating plant growth would be very valuable, especially for early crops.

CROPS AND CULTIVATION.

256 - **The Problem of Agricultural Meteorology** (1). — AZZI, G., in *Bollettino del Ministero di Agricoltura, Industria e Commercio*, Series B., pp. 1-10. Rome, 1916, and in *Bollettino bimensuale della Società Meteorologica Italiana*, Series III, Vol. XXXV, Nos. 6-7-8, pp. 25-32; Nos. 9-10, pp. 39-42. Turin, 1917.

THE PRINCIPLES NECESSARY TO THE SOLUTION OF PROBLEMS OF AGRICULTURAL METEOROLOGY. Among the variations in the yields of crops those caused by atmospheric changes hold the first place. These changes are of

(1) In March, 1911, the general Meeting of the Delegates of the States adhering to the International Institute of Agriculture received favourably the proposal of Mr. LOUIS DOP (French Delegate and Vice-President of the Institute) with regard to the international organisation of agricultural meteorology, and decided to send officially the report to the President of the International Committee of Meteorology.

In September, 1912, at a meeting of the Central Meteorological Bureau, Mr SHAW, Presi-

far greater importance than those due, for example, to the use of fertilisers, to cultivation, etc. For this reason studies aiming at reducing the damage done by meteorological factors deserve the greatest attention. The author has drawn up a very detailed scheme which permits the damage caused by weather to be reduced with certainty, by favouring a more rational adaptation of the various crops to the climates of the different districts.

Three principles are required for the solution of problems of agricultural meteorology: — 1) a knowledge of the critical period; 2) phenological maps; 3) weather charts.

Critical period. — From germination to harvest the plant undergoes great modifications which change its form and structure, so that its requirements, even with regard to the various meteorological factors, vary during the growing period.

The critical period with regard to "rain" is the interval, more or less long, of the growing period during which the plant has an absolute need of a certain minimum quantity of water. If, during the critical period, the total rainfall is below the minimum required for the normal growth of the plant, the harvest will be poor, even through there be abundant rain during the rest of the growing period, and, inversely, if during the critical period the needs of the plant are satisfied, the harvest will be plentiful, even though the rainfall during the rest of the growing period be scarce and badly distributed.

The critical period of cereals falls during the twenty days preceding earing. If, at this moment, there is not sufficient rain to keep the moisture of the soil above a certain limit, the grain harvest will be seriously compromised.

What has been said for rain may be repeated for all the other factors. A plant may, therefore, have more than one critical period, those of rain, frost, temperature, clouds, etc. One or all of these periods may assert itself and assume importance according to the local conditions of the climate.

The necessity of a detailed physiological and meteorological examination is thus obvious when it is desired to ascertain with exactitude in each district the cause of a failure in the crops and the requisite remedies.

Phenological maps. — In a certain number of stations in different parts of Italy the average date is calculated when the peach, for example, flowers, and the data obtained is marked on the map at points corresponding to the various stations. All the districts, in which flowering occurs in the same decade are included in one zone and the various zones marked in different colours. This gives the phenological map of the flowering of the peach tree.

The critical periods referred to above always coincide with some phase of growth (flowering, earing, etc.), that is to say, to a moment when the

dent of the International Committee of Meteorology, formed a commission of 5 members who drew up a scheme of work to be submitted to the International Committee of Meteorology. The commission, on which were placed other technical specialists, should have met in December, 1914. The war interrupted its work. (See *B.* Dec. 1912, No. 1605).

lant undergoes great modifications which make it very sensitive to the ck of rain or to other unfavourable meteorological phenomena. Thus, t the flowering stage of fruit trees, a drop in the temperature, which at her moments of growth would have no effect, suffices to compromise iously the fruit crop.

If the average date of the different stages in the growth of a plant (leaf-g, flowering, ripening of the fruit) are known, it is possible to determine e period of the year during which the plant is particularly sensitive to the rmful action of certain phenomena, or particularly exacting with regard humidity, temperature, etc. Thus, if the average date of flowering of e peach tree at a station A is February 5, the critical period of that tree th respect to frost will be the first 10 days of Febrary. The phenological aps, then, make it possible to determine the critical period. For each riety grown there should be as many phenological maps as there are portant stages of growth in relation to weather. For cereals these e: 1) germination ; 2) earing ; 3) flowering ; 4) ripening of the grain.

Weather charts. — In 1910, in the province of Bologna, there was no in during the 20 days preceding earing, which took place on May 15 ; and e harvest was below the average by about 9 ½ cwt. per acre. On the her hand, there was abundant rain during the first half of April. By rlier sowing and the use of an earlier variety it would have been possible bring the earing stage to April 25-30 so as to make the critical moisture riod coincide with a more favourable meteorological moment. For this, wever, it would be necessary to know at the end of October what the ather could be in spring. It is not possible to make a good weather recast for more than 24 hours, or, at a maximum, 48 ; *the crops cannot, there-re, be adapted to the weather.* If, however, it is impossible to foretell in tumn what will be the atmospheric variations at Bologna and Sciacca icily) during the second half of April, there is no doubt that drought is uch more frequent and likely to occur during this period at Sciacca than Bologna.

If the crops cannot be adapted to the weather, it is possible to adapt them the climate, which represents the average weather and is expressed by a rics of percentages of probability : — probability of frost, drought, storms, ouds, etc.

The author applies the term " dry decade " to a period of 10 days where e total rainfall does not exceed 5 mm. By calculating for a certain num-r of districts over a long period (a minimum of 20 years) the number of nes a certain decade has been dry, and comparing these figures to 100, e probability of drought for this decade will be obtained. Assuming at, at the station A, the 2nd. decade of July has been dry 15 times in years, the probability of drought during this period at A will be 75 %.

This percentage is marked on a map at the points corresponding to e different stations. All the points where the probability of drought is m 70 to 100 % form one zone, in which drought is certain ; those where is probability is from 30 to 70 % form a second zone, and those where it from 0 to 30 % form a third zone where drought is very rare during the

decade under consideration. The zones are marked in different colou In this way a chart will be obtained for each decade which will enabl the distribution of *drought* for a given period to be ascertained at glance. Similar charts would be made for *frost* ("cold decade"), *cloud storms and mist.*

AGRICULTURAL METEOROLOGY STATIONS. — The critical period of plant with regard to a meteorological factor may be restricted to one o two decades. Taking as example the Agricultural School of Imola whe agricultural observations are made, and the nearest meteorological observa tory that of Bologna, about 20 miles away, it may well happen that during the critical period of moisture for wheat, a shower may fall at Bo logna while the drought continues at Imola, or vice versa. A comparison between the phenological and biological data registered at the school and the meteorological data of the observatory may, therefore, lead to erro neous conclusions. It is necessary that the biological and meteorologica observations be carried out at the same time and place: — the agricultura meteorology station.

The author considers that an entirely new scheme is unnecessary more especially as in no case should a new station of agricultural meteo ology be built, use being made of those stations and agricultural schools already existing by supplying them with building, technical staff and experi mental fields. Each station should have the following instruments: —

1) rain-gauge;
2) hygroscope;
3) maximum and minimum thermometers;
4) earth thermometers;
5) bore for taking samples of soil at different depths;
6) balance, oven, and accessories required for determining the moisture in the samples

How many stations are necessary? Where environmental condition are uniform, as in Russia, where similar topographical and climati conditions prevail over long stretches, the number of stations may be rela tively limited. On the contrary, in Italy (as in Greece), with the excep tion of the valley of the Po, which is fairly uniform, the country varies greatly, even within limited zones, so that it would be necessary to have s many stations that the project becomes almost impossible.

Nevertheless, however variable the geographical distribution meteorological phenomena harmful to crops may be, the nature and si nification of the problems of agricultural meteorology remain the sam Thus, in northern Italy, the district in which wheat suffers from lodgi includes all the Po valley, but in central and southern Italy, and in the moun tain districts, the action of rain with wind is usually discontinuous oftendisappearing entirely, without any regularity, in localities sheltered from the wind, according to the topography of the land. The problem however, is the same in each case: — to create a wheat which is both resistant to lodging and a good producer. If it be assumed that wheat suffers from lodging in 200 stations, if in one of these a wheat with a re sistant culm were produced, this type could be introduced with a great

robability of success in all the other 199 stations, wherever they may e situated.

Agricultural research which aimed only at solving well-defined problems onnected with analyses of agricultural meteorology could, therefore, be arried out in a relatively small number of stations if it were known at what oints and to what extent a certain phenomenon is harmful to a given crop. he agricultural stations, and agricultural schools and institutes forming a etwork in all the civilised countries of the world could, if adequately fitted p, be used as agricultural meteorology stations. To this list might be dded the thermo-hyetometric stations, convents, agents and directors f farms, etc. situated even in most distant lands, who could take obser- ations and help to solve the important problems of agricultural geography nd meteorology. Each first class station of agricultural meteorology gricultural stations and schools), together with the second class stations hermo-hyetometric) and points of observation (parishes, etc.) dependant n it, form a *fundamental principle of the system* (*network*).

TABLES OF GROWTH (*their meaning, construction and use in determining a ritical period*). — The data obtained in the stations are collected and clas- fied in tables of growth. Plants are modified during the passage from ger- ination to ripening of the fruit, but the modifications which occur are either gradual nor continuous. There are relatively short phases during hich the plant is greatly modified (disappearance of certain organs and for- ation of new ones) ; it then remains anatomically and physiologically tationary for a long period, till another phase takes place. There are, hus, *phases of growth* (flowering, earing, etc.) and *interphasal periods* or *ubperiods* between two successive phases. It may be assumed that the tructure and requirements of a plant remain constant throughout a sub- eriod.

This phenomenon may be represented by a discontinuous curve, omposed, however, of elements almost parallel to the line of the x joined y almost parallel segments to the line y.

The growing period of cereals is divided into sub-periods as follows : —

1) from sowing till the seedling appears ;
2) from this phase till winter interrupts growth ;
3) from this interruption till growth restarts in spring ;
4) from the restarting of growth to earing ;
5) from earing to complete maturity.

For each of these sub-periods there is a special table — table of rowth — in which are noted all the meteorological and phenological factors f the plant studied, as, for example : —

Table IV. — Wheat. Station..... Year.....

Fourth sub-period — From restarting of growth to earing. .....

1) Variety. . . . . .

2) Date when growth restarted in the whole field . . . . . .

3) Remarks on tillering during the 4th sub-period . . . . . .

By tillering is meant the emission of lateral shoots, which usually takes place in autumn, which may occur in a cold, late spring, as is frequently found in the mountains.

4) Lengthening of internodes. . . . . .
a) day when first observed in a few plants . . . . . .
b) day when observed for the majority of the plants . . . . . .
5) Degree to which temperature, humidity, sun, etc., favour or inhibit the growth of the internodes.— . . . . . .
6) Date of appearance of first ears . . . . . .
7) Date of earing of the majority of plants . . . . . .
8) Development of this phase, whether uniform, rapid or slow . . . .
9) Influence of weather on earing. . . . . .
10) Duration of 4th. sub-period . . . . . .
11) Note, during the 4th. period:
1) frosts . . . . . .
2) storms . . . . . .
3) drought . . . . . .
4) clouds . . . . . .
5) other meteorological phenomena . . . . . .
Note, in each case:
a) date and duration. . . . . .
b) intensity. . . . . .
c) damage caused to plants . . . . . .
d) effect on soil (washing, baking, cracking, etc.) . . . . . .
12) Degree to which the variety grown proved resistant to adverse meteorological factors (drought, lodging, excessive moisture, etc.) . . . . . .
13) Injury by disease or insect attacks . . . . . .
14) Degree to which atmospheric variations favoured the appearance of disease or insects . . . . . .
15) Cultivation of plot during the 4th. sub-period . . . . . .

TABLE I. — *Moisture of soil, height of plants and depth of roots.*

Month and day	Moisture of soil (%)			Date of last rain before taking of sample	Depth of roots, inches	Height of plant, inches
	Active layer	Virgin layer	Subsoil			

Soil moisture. — The periodical determination of the soil moisture at different depths is of great interest, increasing with the frequency with which the determinations are made. However, in view of the amount of work required it is best to allow the directors of the various first class agricultural meteorology stations to decide for themselves the frequency with which such determinations shall be made.

Besides the periodical determinations the soil moisture must be taken at two moments — 15 days before earing, and at the beginning of this phase.

Height of plants. — The height of the plants before earing is measured from the level of the ground to the base of the highest leaf, and after earing from the level of the ground to the tip of the ear. The day the one method is replaced by the other account must be taken of the two factors bearing on the height of the plant calculated from the ground level to the base of

he highest leaf on one hand, to the tip of the ear on the other, as, for exam-
ple, $\frac{72 \text{ (stem)}}{76 \text{ (ear)}}$.

The average height of 10 normal plants taken haphazard here and there epresents the average height of all the plants.

Depth of roots. — A lump of soil, togther with all the plants on it, is aised about 6 inches, and the depth measured on the vertical section. This letermination is made 3 times : — 1) when growth restarts ; 2) 15 days efore earing ; 3) at the moment of earing.

TABLE II. — *Number of plants and culms ; vigour of tillering ; average weight of dry mass of plants ; number and weight of weeds.*

Month and day	Grasses studied									Weeds	
	Number of plants with:										
	one culm	two culms	three culms	four culms	many culms	Total number of plants	Total number of culms	Weight in grams of dry seedling	Vigour of tillering	Number of samples	Weight in grams in dry condition

N. B. — This table must be filled in at the moment when the internodes begin to lengthen.

1) *Vigour of tillering.* — This is calculated by dividing the total num-
r of culms by the number of plants.

2) *Determination of the weight of the plants and weeds.* — In four differ-
nt parts of the plot the plants are uprooted from about ¼ sq. yard ; the eeds are separated from the plant studied ; the root system is removed nd the green part left to dry ; when a constant weight is obtained the value entered in the table.

ABLE III. — *Number of plants and culms ; vigour of tillering ; vigour of earing ; weight of dried mass of the plants ; number and weight of weeds.*

Month and day	Grasses studied											Weeds	
	Number of plants with						Number of culms			Weight in grams of dried plants	Vigour of tillering	Number of plants	Weight in grams in dry condition
	one culm	two culms	three culms	four culms	many culms	Total number of plants	plants earing	plants not earing	Total				

N. B. — This table must be filled in at the end of the earing stage.

TABLE IV.

Month	Meteorological observatory													
	Air temperature							With wet-bulb termometer			Percentage of relative humidity			
	7h.	13h.	21h.	Total	Average	Maximum	Minimum	7h.	13h.	24h.	7h.	13h.	21h.	Average

TABLE V. — *Temperature of soil.*

Date	At the surface				In active layer				In virgin layer				In sub-soil			
	7h.	13h.	21h.	Average	7h.	13h.	21h.	Average	7h.	13h.	21h.	Average	7h.	13h.	21h.	Average

TABLE VI.

Date	Rain		Mist				Clouds	Storms	Other meteorological phenomena
	in inches (or mm.)	duration	7h.	13h.	21h.	Average			

The table of growth (composed of the above tables) is reproduced because it contains all the material necessary to a complete study of agricultural meteorology. For each variety there will be a table of growth corresponding to each of the interphasal periods.

DETERMINATION OF THE CRITICAL PERIOD. — The yield in fruit is the measure by which the more or less favourable action of meteorological phenomena must be judged. The higher the yield the more favourable was the weather during the growing period in general and the critical periods in particular. If the data concerning wheat at station A from 1901 to 1911 were available the following facts could be deduced: — there is no relation between total precipitation and yield in grain or between yield and total precipitation during the 1st., 2nd. and 3rd. sub-periods. If, however, the data on the yield and total rainfall during the 4th. sub-period are compared, a direct relationship is seen to exist. The critical rain period of wheat is then, the 4th sub-period.

By limiting in this way the field of research to a relatively narrow scope is easy to define exactly a critical period. No important phenological ion is observed between the restarting of growth and the earing phase. e critical period, then, is the earing phase. At this moment the plant s the greatest amount of work by elaborating the enormous quantity plastic substances necessary for the formation and development of the yopses and by consuming a great amount of water. There is an average about 40 days between the earing and ripening phases. During this ie occurs the whole process of growth, the last phases succeeding each ier rapidly — flowering, development and ripening of the caryopses.

To assure a good wheat harvest abundant rain is necessary during decade, or two decades, preceding earing so that the plant may have the isture necessary for rapid and strong growth. In warm countries, ere there is a great probability of drought during the earing period, the tical period just mentioned is very evident and has a marked influence on harvest. In proportion as the cold northern countries where rain is nearly ays plentiful at the requisite time are approached, all relation between cipitation and yield disappears, while other critical periods arise, as, example, an inverse relation between yield and rain during flowering.

The specific action of all the other meteorological factors could be ablished in a similar way.

THE MANNER IN WHICH KNOWLEDGE OF THE CRITICAL PERIOD, PHENOLOGICAL MAPS AND WEATHER CHARTS PERMITS AN INCREASE OF YIELD BY APTING THE VARIOUS CEREALS TO THE CLIMATE. — When a scale of the lds has been established (*e. g.* for wheat, cwt of grain per acre), it is posle to distinguish the zones of good, medium and bad harvests. Thus, the ne of good harvests includes districts where the average yield of wheat eeds 13 cwt. per acre, that of poor harvests where the yield is less than ½ cwt. per acre; the medium zones includes the districts with yields ween 9 ½ and 13 cwt.

The aim of agricultural meteorology is to increase the zone of good harts at the expense of the other two. Statistics are but a statement of facts; expression " bad harvest " merely means that the meteorological facs during the period of growth in general and the critical periods in parular are unfavourable to the growth of the plant, but does not show which s the unfavourable factor or the means to remedy it. To do this agricul-al meteorological analysis is necessary. Many meteorological phenomena y damage wheat, for example, in Italy. In the south there may be: —

1) warm, dry winds (sirocco, " favonio ") which, during the ripen- of the ear (5th. sub-period) cause scorching, followed by hastened ri-ing, drying up of the grain, and, while the plants are still strong, the yopses lose food material or do not form at all. This is particularly ious in light soils or where there is only a small layer capable of being cul-ated and, in some years, within a few days, the yield is reduced by 25, or even 50 %;

2) lack of rain during the 10 or 20 days preceding earing;

3) prolonged drought during the period following sowing.

Rust is little to be feared because excessive humidity in spring occu rarely and only over very limited areas. Lodging is unknown because i the islands, most of Calabria and in Basilicata hard and semi-hard grai with short, strong straw is grown.

In central and northern Italy, on the contrary, the following fac must be noted with regard to climate: —

1) in the valley of the Po, particularly in the lowest part, wheat al most invariably suffers from excessive moisture which causes rust with resultant serious decrease of yield;

2) lodging caused by wind and heavy rain at the time of the forma tion and development of the caryopses may lower the yield by 20 to 25 %

3) considerable damage by late spring frosts.

Such is the knowledge, relatively general, at the present day, when th network of agricultural meteorological stations is to begin its work, aimin at *a*) the determination of the critical period of wheat with respect to th meteorplogical factors as discussed above, *b*) the preparation of phenologic maps, and *c*) weather charts.

Once the critical period is known the comparison of the phenological ma and weather charts allows the suitability of a plant to local climatic cond tions to be easily determined. If, for example, at A, wheat ears on Ma 10 on an average, and if, during the last decade of April and the first d cade of May, the probability of drought is 75 and 90 % respectively, th will show why the average yields in this district are relatively low. On the reason of the poorness of the yield is established it may be remedied three ways:

1) Change the time of the critical period phase and make it coinc with a more favourable meteorological moment.

E. g. the *f* variety of wheat at the station A ears on an average 1st phenological map of earing of wheat) on May 12, and the probability drought during the third decade of April and the first decade of May i 90 and 95 % respectively (see weather charts for drought for the 3rd. decad of April and the 1st. decade of May). This accounts for a low yield. I the first and second decade of April, on the contrary, the probability drought at A drops to 10 and 15 % respectively. By earlier sowing by using an earlier type of *f'* wheat, so that earing takes place between Apr 20 and 25, this drawback could be remedied in part at least.

2) Artificial modification, during the critical period, of meteorologic factors, *e. g.* control of frost by smoke, of drought by irrigation, etc. Bri liant results have been obtained with fruit in California by forecasting co by 24 to 48 hours, thus allowing growers to decrease or even nullify injurio effects by burning heavy oils or other substances which surround the u with thick, protective smoke.

3) The introduction or production of types of increasing resistan to drought, frost, rust, lodging, etc.

Modern experimental research in biology in various countries h clearly shown that, by hybridisation and subsequent selection, it possible to unite in one variety the good characters existing

o distinct varieties and to eliminate undesirable characters. In ch particular case the breeder must aim at uniting high yield with istance to the harmful meteorological character most frequent in the trict. Thus, at Svalöf (Sweden), M. NILSSON has obtained types of eat resistant to cold, and at the same time, excellent yielders by crossing most productive varieties slightly resistant to cold (English Square-ad) with native Swedish wheat very resistant to low temperatures.

This acclimatation of non-native types and creation of new types by ssing and selection would be the most important work of agricultural teorological stations of the 1st. class. In the choice of these, therefore, would be made of agronomic and agricultural Institutes already exist-and not of the meteorological Institutes which may cooperate with them t cannot form centres for new research.

The following example shows that agricultural meteorological study is t only necessary where soil is cultivated for the first time, but that it y give excellent results in districts where intensive culture has been car-d out for a long time by determining a better adaptation of crops to the mate of different districts. In the province of Bologna (northern Italy) ch farm may be said to grow three varieties of wheat — Rieti, Gentil sso and Hybride inversable de Vilmorin, distinguished by the following aracters:

1) RIETI: resistant to rust but lodges easily; in favourable years, e. when it does not lodge as a result of storms, it yields about 17 ½ cwt. r acre;

2) GENTIL ROSSO: very subject to rust and lodging; in favourable ars, without excessive humidity and destructive storms, it may yield over cwt. per acre;

3) HYBRIDE INVERSABLE DE VILMORIN: subject to rust but resistant lodging; when the humidity is not excessive it may yield 16 ¾ cwt. r acre.

Gentil rosso and Hybride inversable are of recent introduction, and her varieties, now under observation in various agricultural iustitutes, will ually be added to the pre-existing varieties, causing a mixture of wheat ich is not always desirable. A single variety best suited to the climate d not been adopted because, it is argued, there is no such variety and ne which suffers from the same two causes at the same time, therefore, n any year one variety fails, there is always one which succeeds, thus com-nsating for the loss. This is false reasoning. Gentil rosso, when it does t lodge, produces up to 19 cwt. per acre, Hybride inversable only 16 ¾, 2 ¼ less; but the first lodges easily, whereas the second does not. Lodg-causes a loss of nearly 4 cwt. per acre, thus reducing the yield from 19 15 cwt. The probability of heavy rainfall and wind during the 5th. sub-riod in the province of Bologna is, moreover, 80 %. In a period of 5 years ere would be: — GENTIL ROSSO $19 + (15 \times 4) = 79$ cwt; HYBRIDE INVERSA-E DE VILMORIN $16\ ^3/_4 \times 5 = 83\ ^3/_4$. Thus, in the province of Bologna, ere the probability of lodging is 80 %, the Vilmorin hybrid is preferable Gentil rosso.

When, on the contrary, the probability of storms in the 5th. sul period falls to 20%, GENTIL ROSSO should be preferred: — HYBRIDE DE VI MORIN $16\,^3/_4 \times 5 = 83\,^3/_4$; GENTIL ROSSO $(19 \times 4) + 15 = 89$ cwt.

Agricultural meteorology is, therefore, indispensable if an exact idea the real productivity of a species in a given district is to be determined.

The mere fact that a given variety of wheat is grown by preference, a given district is no proof that it is the best suited to this district. Ne types are often on the market which may completely supersede the natu types, to be superseded later in their turn by other new types. In all su cases it is the character "productivity" which guides the farmer in h choice of seed; but productivity is influenced to a marked degree by c matic conditions, and consequently, varies from one district to anoth so that the adoption of new types should be preceded by a careful study agricultural meteorology.

Agricultural meteorology thus gives a twofold result: —

1) it allows a better distribution of the different varieties of a cu tivated species; *i. e.* it shows the districts best suited to each variety fr the point of view of local climatic conditions;

2) it guides the selector in his research aiming at uniting to the l advantage in a single type, productivity and resistance to the most destru tive meteorological phenomena of the different districts.

The work of adapting crops to climate is difficult, but it cannot fa to lead, in part at least, to positive results, and considering the size an complexity of the problem, these results, even though they be but smal represent large figures.

Unfavourable conditions in Italy diminish the grain harvest, on a average, by over 3 cwt. per acre, and though only ½ cwt. per acre were gaine the profit would be 9 432 980 cwt. representing a considerable value.

What has been said for wheat applies equally to all other cultivat plants; what has been said for Italy applies to all the countries of the worl On the other hand, it is seen that the network of agricultural meteorolo stations is already outlined by the many agricultural schools and institu and the thermo-hyetometric stations possessing the premises, instrument experiment fields and technical staff. All that is required is to collect, c ordinate and develop all this latent or dispersed activity, so that the co of the formation and upkeep of the new service shall be limited.

257 – **The Relation of Winter Temperature to the Distribution of Winter and Spri Grain in the United States: Why Cereals Winterkill.** — SALMON, S. C., I. *Jour of the American Society of Agronomy*, Vol. IX, No. 8, pp. 353-380; II. *Ibid.*, Vol. I No. 1, pp. 21-24. Washington, 1917.

I. — In northern districts winter cereals usually give a higher yield th spring cereals, but they are much less widely distributed because they a naturally excluded from zones where the climate is too severe to allow t young plants to survive the winter. The injurious action of the win may have four effects: —

1) HEAVING. — This is due to expansion and contraction of the s by alternate freezing and thawing; the roots are broken and exposed

e air. Shallow sown plants suffer least, as the whole plant will then be ted without breakage of the underground parts. Heaving is most com- on in the eastern States, especially in wet, badly drained plains.

2) SMOTHERING. — Alternate freezing and thawing sometimes turn the ow into an ice sheet through which the air cannot pass, thus suffocating e plants by lack of air and accumulation of carbonic acid.

3) PHYSIOLOGICAL DROUGHT. — This occurs when the soil is frozen id the plant can no longer obtain moisture from it. All the anatomical iaracters which tend to limit transpiration should, therefore, be in cor- lation with resistance to cold. Turkey and Kharkov wheat; winter rye id winter Turf oats, known for their resistance to cold have marked xero- hytic structures — narrow leaves and prostrate habit of growth, which irtially protect the plant from the action of wind (KOLKUNOW, SINZ, etc.). he author and his collaborators, in a study on several varieties of winter heat, rye, barley and oats, found no definite relation between resistance to old, cell structure, epidermal covering and ability to control transpiration. ecent studies have, however, shown that a reduction of the leaf area in elation to the length of the root as expressed by the ratio of root length to af area does influence the resistance of young plants to cold. In Turkey heat this ratio is 25 % greater than in Fultz wheat, a less hardy variety, nd 40 % greater than in common oats and barley. Physiological drought ay be considered, if not as the only cause of winterkilling, at least as the ost important.

4) DIRECT EFFECT OF LOW TEMPERATURE. — This acts in many ways: —

a) Mechanical action. — Injury to the tissues caused by the formation f ice.

b) Desiccation of the protoplasm. — Low temperatures cause with- rawal of water to the intercellular spaces, where it freezes; when later, heice thaws rapidly the moisture can no longer be absorbed. At — 13°C. he loss of water is 63.7 %; at — 15.2°C., 79.2 %.

c) Coagulation of the proteids. — In plants resistant to cold this only akes place at very low temperatures; thus for pine needles a temperature f — 40°C is required, in winter rye — 15° and in begonia, which is very sen- itive to cold, — 3°C. This coagulation is accompanied by denaturing of he proteids, caused, perhaps, by increased acidity of the sap, so that they an no longer be reabsorbed. This theory is held by GORKE but contra- cted by CHANDLER'S experiments, which showed zinc sulphate, one of e salts which readily coagulate proteids, to increase rather than to dimi- ish resistance to cold.

LIDFORSS, in his studies on *Holosteum, Cerastium, Lamium, Veronica, enecio, Viola, Fumaria,* etc., observed that, on the approach of winter, e starch in the tissues of these plants changed to sugar, which, by changing e concentration of the sap, reduces the freezing point. These phenomena f the protective action of various substances due to the lowering of the eezing point have formed the subject of much research (MAXIMOV, etc.), hich confirms the theory of LIDFORSS.

II. — The specific action of low winter temperatures on winter ce-

reals is clearly shown by a study comparing the northern boundary o different varieties with the isotherms of the minimum temperatures du ing January and February.

WINTER WHEAT. — Its northern limit corresponds approximately t the isotherm of 10°F (— 12.2° C.). Cold resistant varieties may exceed thi limit if the seed is well protected by a covering of snow.

WINTER BARLEY. — Its northern limit coincides with the isotherm o 20°F. (— 6.6° C.). It is successfully grown to the west of the Rocky Moun tains and to the south of the Ohio and Platte rivers.

WINTER OATS. — Its northern limit corresponds to the isotherm o 30° F (— 1.1° C.). They may be grown, in the north, as far as Central Ten nessee and Arkansas and southern Maryland and Oklahoma.

PHYSICS, MISTRY AND BIOLOGY

258 – **Effect of Decomposing Organic Matter on the Solubility of certain Inorganic Constituents of the Soil.** — JENSEN, C. A. (Assistant in Plant Malnutrition, Offic of Biophysical Investigations, Bureau of Plant Industry, U. S. Department of Agr culture), in the *Journal of Agricultural Research*. Vol. IX, No. 8, pp. 253-258 Washington, May 21, 1917.

The experiments described were undertaken to determine if the bene ficial action of decomposing organic substances (humus) is due to the solu tion of the inorganic substances of the soil, and, if so, to what extent. Wate extracts of green barley hay, sweet clover and alfalfa were prepared by satur ating 70 gm. of each of these substances in a flask with distilled water, and allowing them to ferment for 14 days. After this period the substances were thoroughly shaken with 1500 cc. of distilled water, and filtered, first through muslin, then through a Chamberland filter. The insoluble residue was again treated in the same manner and other extracts obtained from it. The ex tracts thus obtained were added to soils in the proportion of 500 cc. of solvent to 250 gm. of soil. The soils used were clay loam and sandy loam.

It was found, in the first place, that by extracting soils with thes solutions, two to five times as much calcium was removed as was added t the extracts. In most cases even more magnesium was removed than wa added, the increase varying from a small fraction to 80 %. Iron an phosphoric acid were removed in smaller quantities than they wer added in the extracts, but the iron dissolved exceeded that dissolve by water by 1.7 to 5.4 times. The solvent action of the different extract was about the same whether they were prepared from leguminous or non leguminous plants.

Extracts obtained in a similar way from cow manure removed les calcium from the soil than did vegetable extracts, but their action was th same for the other mineral constituents.

Both the organic and inorganic salts of the aqueous extracts seem t contribute to the solution of the mineral substances of the soil.

Artificial green manures (barley hay, sweet clover, bean straw alfalfa, etc.) kept moist till thoroughly decomposed, and gave extracts whic removed a greater quantity of calcium than was added ; they also remove amounts of magnesium, phosphoric acid and iron in excess of thos dissolved by water alone. The green manure extracts gave no alkalis

action to phenolphthalein and no acid reaction to methyl orange. When ie soil was mixed with 3 % green manure and stable manure and left till artially decomposed, the solubility of the calcium and phosphoric acid creased from 30 to 100 %.

To study the action of the organic constituents of the extracts tested, een manure and sugar were hydrolysed with strong acid, washed till ee from acid, then extracted with ammonia. When the ammonia was iminated these extracts represented artificial humus solutions free from lcium, magnesium, iron and phosphoric acid. These extracts, when ad- ed to soil, increased the solubility of the calcium as compared with its olubility in water by amounts varying from a few parts to 240 parts per illion of soil. They also increased to a lesser extent the solubility of agnesium, phosphoric acid and iron.

In short, in the soils tested, the solubility of calcium, magnesium, iron nd phosphoric acid is appreciably increased by the addition of green manure, able manure or their extracts This increase in solubility is due, partly to he action of the inorganic salts contained in these substances, and partly o the solvent action of the organic compounds formed during decomposition. he fact that a deficiency in soluble iron causes certain types of chlorosis uggests that the beneficial effect of the addition of organic matter to itrus soils depends partly on its solvent action on iron and other soil ompounds, though this has not yet been definitely proved.

59 - **The Proof of Microbial Agency in the Chemical Transformations of Soil.** — Conn, H. J. (New York Agricultural Experiment Station), in *Science*, Vol. XLVI, No. 1185, pp. 252-255. Lancaster, Pa., September 14, 1917.

Care must be taken to avoid inexact statements and ill-founded conclu- ions as to the part microorganisms play in the chemical changes occurring soil. In soil microbiology there are statements and deductions similar o those found regarding pathology till light was thrown on it by the funda- ental postulates laid down by Koch for the study of pathogenic bacteria.

Extending these postulates, by analogy, to bacterial activity in soil, he author lays down the following principles for research in soil micro- iology :

a) The organism to which action is attributed must be shown *to be resent in the soil in an active form when the chemical change studied is taking lace ;*

b) this organism must be present in larger number, under such conditions, han in the same soil in which the chemical change is not occurring ;

c) it must be isolated and studied in pure culture ;

d) the same chemical change must be produced by the organism in experi- entally inoculated soil, the test being made, if possible, in unsterilised soil.

These facts can be shown by the cultural methods used up to the pre- ent. It must, however, be remembered that they may lead to errors be- ause naturally inactive organisms may be present which become active nder cultural conditions, or the opposite may occur. Cultural methods ust, therefore, be checked by others; the microscope may be useful in his respect, but it may prove necessary to devise entirely new methods.

260 - **The Decomposition of Soil Protein Substances Through the Action of Bacteria.** — ROBINSON, R. H. and TARTAR, H. V., in *The Journal of Biological Chemistry*, Vol. XXX, No. 1, pp. 135-144. Baltimore, May, 1917.

The experiments described were carried out at the Chemical Laboratory of the Oregon Agricultural Experiment Station, Corvallis. The function of bacteria in the production of ammonia from the protein substances in soil has long been known. How these proteins are acted upon, whether it be a hydrolytic process brought about by enzymatic action, whether it be an oxidative one, or a more complex chemical reaction is still unsolved. This led the author to undertake a series of experiments to ascertain, by controlling the influencing factors as much as possible: — 1) the chemical changes proteins undergo when acted upon by bacteria; 2) the cause of partial ammonification of protein substances; 3) the nature of the reactions in general.

The proteins used were blood fibrin, egg albumin and peptone; the bacteria: *Bacillus subtilis*, *B. mycoides* and *B. vulgaris*. The results obtained show that: —

1) All the nitrogen forms are more or less changed by the action of the bacteria and the end-product ammonia is formed. In no case was one form of nitrogen completely destroyed.

2) The rapidity of action varies greatly with different protein substances; casein showed no further change after a few days, whereas gliadin continued to ammonify after 30 days.

3) One organism does not act alike upon different proteins. The relative proteolytic activities of the organisms used depend on the protein acted upon.

4) The monoamino-acid nitrogen and diamino-acid nitrogen of the protein are the chief sources of the ammonia formed by bacterial action.

5) The similarity of chemical change between the action of acid hydrolysis and that of bacteria indicates that the latter is largely hydrolytic to the point of formation of various amino-acids.

6) No toxic substance that would inhibit complete ammonification of a protein is formed.

ANENT EMENTS: GE AND ATION

261 - **Irrigation of Orchards in U. S. A.** — FORTIER, SAMUEL, in *U. S. Department of Agriculture, Farmers' Bulletin* No. 882, pp. 40, 30 figs., illustrations. Washington, D. C., October, 1917.

This bulletin is a revised edition of that on the irrigation of orchards in the west of the United States, published in 1910.

In the arid and semi-arid districts of the United States the irrigation methods vary with the water supply, climate, soil and situation of the land. The cost of installing and maintaining a system varied greatly. The value of water for irrigation has greatly increased of recent years, and in many districts there is a scarcity of water at certain times. For these reasons many orchard-owners have installed pumps to raise underground water. In 1914 there were in California alone 24 600 plants for raising water for orchard irrigation purposes. In other parts of the West reservoirs are being

upplement the insufficient flow in late summer. The canals, previously ply open ditches in earth, have been improved and lined with concrete, in many cases, replaced by underground pipes to prevent loss of wa- The water is often supplied by companies, who have also greatly im- ved the distribution of their water.

The trees are planted in lines, squares or hexagons. The most com- n method of irrigation is by furrows between the rows of fruit-trees. se furrows vary in depth, length and distance apart according to the surface, quantity of water to be used, etc. The head ditches and those distributing the water in the furrows may be built in various ways, some hem very expensive and only justifiable for large orchards. The bul- n describes the most common types of head flumes, which may be of d, cement or concrete. The number of furrows between the rows of s varies with the space between the rows, the age of the trees, the depth he furrow and the character of the soil. Deep ditches are usually pre- ed, the most common depth being 8 inches. The grade of the furrows ies; in ordinary soils it does not exceed 3 to 4 inches per 100 feet. The hine generally used for tracing furrows in citrus orchards consists of lky frame to which are attached two or three double moldboard ploughs; 2 to 14 inch corn lister is also used for deeper furrows. The length of ditches varies from 300 to 600 feet. The time required to irrigate ends on the quantity of water used, the length of the furrow and the ure of the soil.

The orchards are also sometimes irrigated by the basin method by ning, midway between the rows of trees, ridges at right angles to each er. By this method the land is divided into squares with a tree in the tre of each ; more rarely each square contains four or more trees. This hod has recently been renewed in California because, while thoroughly stening the soil, it allows the growing of alfalfa and other leguminous nts, to the great advantage of the orchard.

M ny orchard owners base the interval between two irrigations on examination of the vegetation ; they renew the stream when the trees w visible signs of suffering, *i. e.* when their leaves begin to change colour urf. This method is not practical and it is the moisture content of the which should be considered. In the state of Washington there are e or four waterings at intervals of 20 to 30 days, the first being given April or early in May. In Idaho there are three irrigations, beginning ut June 15. In Montana the orchards are irrigated towards July 15, gust 10 and August 20. In southern California the citrus trees are wa- d six or seven times during the summer at regular intervals.

The bulletin also deals with loss by evaporation and percolation with drainage which, under certain conditions is frequently neces- y.

- **Irrigation with Pumped Water in Montana, U. S. A.** — See No. 336 of this *Review*.

263 – **The Influence of Fineness of Division of Pulverised Limestone on Crop Yield as well as the Chemical and Bacteriological Factors in Soil Fertility.** — KOPELOFF N., in *Soil Science*, Vol. IV, No. 1, pp. 19-67 + 2 figs., bibliography of 124 publications Baltimore, July, 1917.

After discussing in detail the work published on the liming of soils th author gives the results of his experiments made on various soils wit pulverised limestone passed through sieves of 20-40, 60-80, 100-200 an more than 200 mesh. These experiments were compared with contro plots with burnt lime.

An increase in the fineness of the lime gave a proportiona increase in the yield and nitrogen content of crimson clover. The fin the lime the more rapid was the neutralisation of the acidity of t soil and the greater the bacterial processes of ammonification, nitrificati and nitrogen fixation. In the case of barley, buckwheat and rape, fi limestone without nitrogen gave yields equal to those obtained with coa limestone with an application of 660 lbs. of ammonium sulphate per ac Limestone passed through a 200 mesh sieve may be considered as effi cious as burnt lime. An increase in the fineness of the limestone decrea the lime-requirement of the soil, but the drainage waters show a sma loss of ammonia and nitric nitrogen, but an increased loss of calcium.

264 – **Fermentation of Manure Treated with Sulphur and Sulphates : Changes in Nitrogen and Phosphorus Content.** — AMES, J. W. and RICHMOND, T. E. (Ohio Agricultural Experiment Station), in *Soil Science*, Vol. IV, No. 1, pp. 79-89, bibliography of 21 publications. Balt'more, July, 1917.

It is known that the addition of acid phosphate to manure help preserve the nitrogen, and the treatment of manure with gypsum is al common practice. Recently, however, LIPMAN and his co-workers h called attention to the beneficial effect of treating compost heaps with phur and the by-products of mineral phosphates (" floats ") which su available phosphorus (1). To study the influence of sulphur and other terials on the fertilising value of manure as measured by its compos and effects on crops, the authors carried out experiments with solid l manure and cow's urine treated and untreated with sulphur, calcium sulp and acid phosphate. The manure was left to ferment in large conta and applied to small plots. The nitrogen, phosphorus, sulphur and matter in the manure were then determined.

After 250 days' fermentation the loss of dry matter in horse m mixed with a litter of fine cut straw was: — 32.5 % when untreated, 21 when treated with 342 grams of acid phosphate or 407 grams of cal sulphate per 30 lbs. manure, and 18.2 % when treated with 90 g of flowers of sulphur per 30 lbs. of manure. Manure treated with aci phate, calcium sulphate and sulphur only lost about 3.5 % of its

(1) LIPMAN, J. G., MCLEAN, H. C. and LINT, H. C., The Oxidation of Sulphur in a Means of Increasing the Availability of Mineral Phosphates. *Soil Science*, Vol. I. pp. 533-539, 1916. ID. Sulphur Oxidation in Soils and its Effect on the Availability of Phosphates. *Ibid*, Vol. II, No. 6, pp. 499-538. (*Ed.*)

trogen, whereas the loss in untreated manure was 10.5 %. Both the ater-soluble and the citrate-insoluble phosphorus was decreased in every ase. During fermentation manure treated with sulphur increased in acidy, whereas the untreated sample became alkaline.

Sulphur, calcium sulphate and acid phosphate were all very effective preventing loss of nitrogen from urine. In 5 weeks the untreated urine st 80 % of its nitrogen, that treated with 7 grams of sulphur per 500 cc. st 10 %, that treated with 27 grams of calcium sulphate per 500 cc. lost 72 % and that treated with 27 grams of acid phosphate per 500 cc. lost 1 %. Sulphur also prevented the formation of ammonium salts, whereas ith calcium sulphate 68 % of the total nitrogen was transformed into amonium sulphate. In urine treated with acid phosphate and kept in an pen jar for 27 days no ammoniacal nitrogen was formed, but after being ept 3 months in a closed jar it turned alkaline and evolved ammonia.

965 - **Garbage Tankage, its Composition; The Availability of its Nitrogen and its Use as a Fertiliser.** — SCHROEDER, P. J. (Bureau of Soils, U. S. Department of Agriculture), in *The Journal of Industrial and Engineering Chemistry*, Vol. IX, No. 5, pp. 513-518. Easton, Pa., May, 1917.

In about half of the towns of the United States garbage is treated by 9 companies and municipalities for the extraction of fat; the residue, alled "tankage" is considered as a low grade fertiliser. In 1914, 1 200 000 ons of garbage were dealt with yielding, besides the fat, 173 000 tons or 5 % of tankage, valued at $ 1 157 000 at pre-war prices, but now worth lmost twice as much. If the garbage of all towns with a population f more than 30 000 were so dealt with, the production of degreased arbage would exceed 345 000 tons and be worth over 4 million dollars.

In some cases the bits of glass, tin, etc. are first eliminated from the arbage; it is then treated by one of the following methods: —

1) Cooking under pressure with steam (tanking); elimination, as mplete as possible by pressing, of water and fats liberated, from which e oil is separated by settling and skimming; extraction with gasoline of e grease remaining in the solid residue after it has been dried.

2) Crushing to render the particles uniform in size; drying, followed y extraction with gasoline; grinding of the solids for tankage.

3) Heating with boiling gasoline to evaporate the water and extract e fat.

In some plants where the first process is used the dried tankage is not xtracted with gasoline for the recovery of the fat; in others the aqueous olution is evaporated to a sticky consistency and mixed with the degreased ankage which is then re-dried.

In appearance garbage tankage is a coarse, brown powder, either granular or finely fibrous; it generally contains bits of bone, crockery or glass in roportions varying with the degree of care with which the sorting has been arried out. The appended table gives the average chemical composition of 75 samples of raw garbage and 20 samples of tankage from various plants; the fat was not extracted from four of these last samples.

Average composition of treated and untreated garbage.

	Moisture	Ash	Ether extract	Potash	Nitrogen	Phosphoric acid	Combustible matter
Raw garbage	73.78%	3.60%	5.32%	0.27%	0.70%	0.43%	22.63%
Tankage	3.67*	29.15*	4.92*	0.80*	2.78*	3.56*	—

* Percentages calculated on moisture free basis.

Attempts have recently been made to use tankage as cattle food by employing flotation methods to remove the hard matter. It is, however, largely used as fertiliser material, to which, by its composition, it is well suited. It has only been used successfully as a low grade fertiliser and its high organic content makes it of increased value for soils poor in humus.

Tankage is sold at a relatively low price because of the general opinion that its nitrogen is of a limited fertilising value. The author's investigations show this opinion to be erroneous; estimations by the alkaline permanganate method showed 40 % and more of assimilable nitrogen as compared to 57 % in cottonseed meal, and nitrification tests gave equally good results. About ¼ of the total nitrogen of garbage is soluble in water, and this proportion may be increased considerably by treatment with sulphuric acid.

Seeing that other high-grade organic nitrogen fertilisers, such as cottonseed meal and slaughter-house residues, are being used more and more as food for stock, and that garbage tankage contains a large amount of nitrogen, garbage tankage should be more generally used as a fertiliser, thus permitting not only of a more complete utilisation of the garbage, but also of increased municipal profits.

266 – **Effect of Three Annual Applications of Boron on Wheat** (1). — COOK, F. C., and WILSON, J. B. (Bureau of Chemistry, U. S. Department of Agriculture), in the *Journal of Agricultural Research*, Vol. X, No. 12, pp. 591-597, bibliography of 6 publications. Washington, September 17, 1917.

In the experiments described, horse manure, containing sufficient borax to kill fly larvae, was used as fertiliser on plots on which wheat was grown during three successive years to determine whether boron used as larvicide is detrimental to wheat. At the same time another plot was treated with manure containing colemanite (a borate of lime). There was also one plot used as manured control and another used as unmanured control. The borax was applied at the rate of 154 lbs. of boric acid per acre (a quantity sufficient to kill the larvae) during the first year, and at the rate of 38.5 lbs. per acre during the two subsequent years. The colemanite, a less efficient larvicide, was applied at the rate of 50.75 lbs. of boric acid per acre each year.

In the case of large applications of borax during the first year a considerable yellowing of the young wheat plants was noticed and, as compared with

(1) See *R. Aug.*, 1916, No. 854. (*Ed.*)

manured control plot, a reduction of 10 % in the yield during the first years, whereas the effect of colemanite was hardly noticeable. In last year all the yields were low except that of the borax-treated plot, ch was relatively high.

The wheat absorbed only minute amounts of boron (slightly more, how- , from the borax), and the distribution of the boron was relatively orm in the straw and the grain.

The presence of soluble boron was found in the soil after a heavy ap- ation of borax, but not in the other cases. The boron apparently is lually combined in an insoluble compound and so distributed that the er 6 inches of soil show little total boron after three yearly additions of ax. There is no evidence of any cumulative action of boron in the soil. s apparently the soluble boron, not the total boron, in the soil which res wheat plants.

- Occurrence of Manganese in Insect Flower Stems. — Mc. DONNELL, C. C. and ROARK, R. C. (Insecticide and Fungicide Laboratory, Miscellaneous Divis'on, Bureau of Chemistry, U. S. Department of Agriculture), in the *Journal of Agricultural Research*, Vol. XI, No. 3, pp. 77-82, bibliography of 16 publications. Washington, October 15, 1917.

To detect the adulteration of pyrethrum insect powder (*Chrysanthemum rthrum*] *cinerariaefolium* Vis.) UNGER (1) recommended testing it for presence of manganese, which is absent in pyrethrum stems. This state- it has been contradicted by other workers. The authors carried out ntitative determinations of the manganese content of the stems and n and closed flowers of pyrethrum of both Dalmatian and Japanese gin.

The analyses showed the manganese content of both stems and flowers ary considerably, and the difference between the two parts of the plant e so small that the determination of the manganese content as a control he amount of stem in an insect powder would be useless. Moreover, ethrum from Japan contains more manganese than that from other coun- s, owing, presumably to the high manganese content of the volcanic s of Japan. An increase in the manganese content of pyrethrum is ompanied by a slightly higher nitrogen and phosphoric acid content.

- The Proteins of the Peanut, *Arachis hypogaea*: The Distribution of the Basic Nitrogen in the Globulins Arachin and Conarachin. — JOHNS, CARL O. and JONES, D. BREESE, in *The Journal of Biological Chemistry*, Vol. XXX, No. 1, pp. 33-38 Baltimore, May, 1917.

In a recent paper (2) the authors showed that the globulins of the pea- contain a relatively high percentage of basic nitrogen; arachin, the f protein of the peanut, contains 4.96 %, and conarachin 6.55 %. se values were obtained by the Hausmann method, in which no correc- is made for the solubility of the phosphotungstates of the bases, and therefore, lower than those obtained by the Van Slyke method, in

(1) UNGER, H., Flores Chrysanthemi, *Pharm. Ztg.* XXXII, 96, 685-686, 1887. — ID. XXXIII, 23, 166-167; 1888. — (2) See *R.* Feb., 1917, No. 128. (*Ed.*).

which this correction is made. The authors, therefore, analysed these globulins by the Van Slyke method and found both to contain arginine, histidine, lysine and cystine in the following proportions :

Percentage of Basic Amino-acids in the Globulins of the Peanut.

	Arachin	Conarachin
Arginine	13.51	14.60
Histidine	1.88	1.83
Lysine	4.98	6.04
Cystine	0.85	1.07

The figures for cystine are undoubtedly too low as they represent only the cystin which escaped destruction during the hydrolysis of the proteins with hydrochloric acid.

The two globulins also give a marked reaction to tryptophane. Considering the high proportion of lysine in the proteins of the peanut and peanut meal (which contains about 28 % of protein [N×6.25] when made from whole nuts, and 45 % when made from shelled nuts), both might be advantageously used to supplement diets deficient in lysine (1). For example, gliadin, the protein of wheat, only contains 1.21 % of lysine, zein, the protein of maize, contains none at all. On the other hand legumin of the pea and phaseolin of the kidney bean are relatively rich in lysine, containing 4.29 and 4.58 % respectively.

269 – **Sedoheptose, a New Sugar from *Sedum spectabile*.** – LA FORGE, F. B. and HUDSON, C. S., in *The Journal of Biological Chemistry*, Vol. XXX, No. 1, pp. 61–7. Baltimore, May, 1917.

The aqueous extract of the leaves and stems of *Sedum spectabile* contains a non-fermentable, reducing sugar. Analyses of its crystalline phenyl and bromo-phenyl osazones show it to be a new heptose which the authors call sedoheptose. By reduction of a solution of the sugar with sodium amalgam, two heptahydroxy alcohols, designated as α and β sedoheptitol were obtained. In all probability sedoheptose is a ketose, as bromine does not oxidise it and the two above-mentioned alcohols probably result from its reduction.

270 – **Influence of Hydrogen-Ion Concentration of Medium on the Reproduction of Alfalfa Bacteria.** – FRED, E. B. and LOOMIS, N. E. (Department of Bacteriology, University of Wisconsin), in the *Journal of Bacteriology*, Vol. II, No. 6, pp. 627–1 diagram, bibliography of 7 publications. Baltimore-London, November, 1917.

MICHAELIS, CLARK and others have shown the hydrogen-ion concentration of the medium to have a great influence on its reaction and the bac

(1) OSBORNE and MENDEL (*Journal of Biological Chemistry*, Vol. XVII, p. 325, 1914) other workers have shown that lysine is essential to the growth of animals. Nutrition experiments (HOPKINS, F. G., *Journal of the Chemical Society*, Vol. CIX, p. 629, 1916) have shown that the animal organism cannot synthesize lysine which must, therefore, be supplied in food in sufficient quantity to ensure normal growth.

OSBORNE and JONES (*American Journal of Physiology*, Vol. XXIV, p. 438, 1909) found the following different percentages of lysine in the muscle substance of different animals: – sole (*Pleuronectes irradians*), 5.77 %; halibut (*Hippoglossus vulgaris*), 7.45 %; chicken, 7.24 %; 7.59 %. See also *B*, Jan., 1915, No. 72. (*Ed.*).

l processes. Certain species are very sensitive to slight changes, whereas ıers develop in a medium having considerable variation in reaction. The thor studied the effect of this reaction on the growth of *B. radicicola* m alfalfa.

As culture medium was used a mannitol solution composed of mannitol gm., magnesium sulphate 0.2 gm., monobasic potassium phosphate 0.2 ., sodium chloride 0.2 gm., calcium sulphate 0.1 gm., distilled water)0 cc. This solution was divided into 24 parts of 100 cc. each, and the ıction changed by the addition of N/10 sulphuric acid or sodium hydro-le. The hydrogen-ion concentration was determined immediately after ıculation and again two weeks later. The results, given in tables and ıgrams, show that the change in hydrogen-ion concentration is much ıater with a given increase in acidity than for a corresponding increase alkalinity, especially after bacterial growth has continued for two eks. There is a correlation between "hydrogen-ion concentration" and rowth of *B. radicicola* of alfalfa". This bacterium is much more sensitive sulphuric acid in mannitol solution than to gram equivalent amounts sodium hydroxide. The results confirm those of PRUCHA (*New York ricultural Experiment Station, Cornell, Memoir* 5, pp. 41-47, 1915), who ınd that normal hydrochloric acid is much more injurious to the multi-cation of *B. radicicola* of alfalfa than equivalent amounts of normal so-ım hydroxide. The apparent resistance of legume bacteria to alkali ems to be due to the slight concentration of hydroxyl-ions in the manni-solution. The highest count was obtained in a neutral solution; small ıounts of alkali had very little effect on the number of bacteria. On ? other hand, acid in gram equivalent amounts seriously retarded or ıibited growth. The relation of "growth" to "hydrogen-ion concentra-n" remained almost the same after two and four weeks.

The curves representing the hydrogen-ion concentration of mannitol ution before and after the growth of *B. radicicola* show clearly that the ıcentration changes under the effect of the growth of the bacteria, which, parently, bring about changes in the reaction of the medium favourable their reproduction.

- Influence of Position of Grain in the Cob on the Growth of Maize Seedlings. — HALSTED, BYRON D. and OWEN, EARLE J., in the *Journal of the American Society of Agronomy*, Vol. IX, No. 6, pp. 267-275. Washington, D. C., September 25, 1917.

The experiments were made at the New Jersey Agricultural Station th 5 ears of each of 20 representative varieties and crosses of maize. The ins from each ear were divided into 10 equal lots, each representing a zone the ear, ranging from the butt to the tip. The average weight of the grains each zone of 2 of the 5 ears was determined, and 25 kernels from each lot ınted 1 inch deep in a greenhouse bed. In the butt and the tip zones ? smallest perfect kernels were chosen; in the others they were taken at ıdom. The plants were harvested 17 days after sowing.

The emergence of the tips of the seedlings was recorded daily and the erages calculated from it. At harvest time the viability, weight and

length of the seedlings were recorded, and the vigour and variability deduced from them. By averaging the 5 units in each set, a series of tables was obtained showing the relationship of the position upon the cob to the following particular characters under consideration: 1) weight of grain; 2) specific gravity of grain; 3) emergence of seedlings; 4) viability of seed; 5) weight of seedlings; 6) length of seedlings; 7) variability in length. Table I gives information concerning the average weight of the grain, Table II the order of the 7 characters considered; No. 1 represents the minimum, No. 10, the maximum value of the averages.

TABLE I. — *Average weight (in centigrams) of grains of 20 varieties of corn in each of 10 zones from the butt to the tip of the ear.*

Varieties	Zone										Av.
	Butt									Tip.	
	1	2	3	4	5	6	7	8	9	10	
Longfellow	43	44	43	42	42	40	39	37	35	31	3
Hickory King	52	55	56	53	53	51	48	46	46	42	5
Golden Queen (ripe)	16	17	16	16	15	12	13	13	12	10	1
Golden Queen (unripe)	6	6	7	7	7	7	6	5	4	3	
Champion White Pearl	40	39	38	37	37	35	35	34	33	29	3
Reid Yellow Dent	29	29	28	28	27	26	24	22	20	17	2
Iowa Silvermine	32	32	32	31	31	29	28	27	27	24	2
Boone County White	40	38	38	37	35	34	33	32	31	28	3
King 100-Day	40	38	36	36	36	36	36	34	33	28	3
Early Leaming	34	35	35	34	32	32	32	31	31	29	3
Brazilian Flour	30	31	31	31	31	30	29	28	27	24	2
Stowell Evergreen	30	28	27	26	26	25	25	24	23	21	2
Black Mexican	28	30	29	29	29	28	27	26	23	20	2
Country Gentleman	18	15	15	14	14	13	13	14	12	11	1
Golden Bantam	26	27	27	27	26	26	24	23	21	18	2
Crosby Early	25	25	24	23	23	22	20	20	18	17	2
Golden Queen × Hickory King	26	28	29	28	28	27	27	25	23	18	2
Squaw × Country Gentleman	25	25	25	24	24	23	23	22	22	18	2
Golden Queen × Champion White Pearl	27	27	26	27	26	25	24	22	21	18	2
Golden Queen × Brazilian Flour	24	24	24	23	23	22	21	21	20	18	2
Total	591	593	586	575	565	545	530	508	481	424	
Average	29.6	29.7	29.4	28.8	28.3	27.2	26.5	25.4	24.1	21.2	

Thus, for the general average, with the exception of the butt zone, the *weight of the grain* decreases from the butt to the tip.

TABLE II. — *Order of the averages for the characters studied.*

Character	Zone									
	1	2	3	4	5	6	7	8	9	10
Weight of grain	9	10	8	7	6	5	4	3	2	1
Specific gravity	4	5	7	8	9	10	6	3	2	1
Emergence	1	10	9	8	6	7	5	2	4	3
Viability	1	3	4	10	7	9	6	8	5	2
Vigour	2	9	8	10	7	6	5	4	3	1
Length	2	3	9	10	8	7	6	5	4	1
Variability	10	8	3	5	4	2	6	1	7	9

The *specific gravity* ranges from 1.35 in Golden Queen to 1.16 in Brazilian Flour. The sweet corns have a high specific gravity, due to their low starch and high sugar content and the horny texture of their endosperm. The cross between the two above-mentioned varieties has a specific gravity almost exactly intermediate to the two extremes — 1.26; the other two crosses are also near the mother plant. In a general way the specific gravity decreases in both directions rather regularly from the middle of the ear. If 5 groups are made from base to tip, the totals of the ranking figures are 9, 15, 19, 9, 3. This shows that the decrease is much more rapid in the upper than in the lower half of the ear. If only 3 groups are made, namely, the basal three, the middle three, and the 4 upper zones, the averages of the specific gravities are 1.25, 1.26 and 1.24.

As regards *rapidity of germination* (time between sowing and emergence of the tip), the average for all zones is somewhat less than one week (6.44 days). The butt zone emerged the quickest (a little over 6 days), while the zone just above it took 10 hours longer and was the slowest of all the zones. There was a fairly uniform decrease in time for emergence from the 2nd. to the 9th. zone. This is in correlation with the specific weight, *i. e.* the lighter the grain the more rapid is emergence.

The general average of the *viability* of the grain was 91,91 %, although the unripe ears of Golden Queen only gave 67.87 %. Brazilian Flour 6,94 % and Stowell Evergreen a little more. As has been always observed in previous studies sweet maize, as a group, has the lowest viability. The maximum viability is found in the 4th. zone (94.44 %); the minimum in the basal one (87.68 %), which is closely followed by the tip. The five best zones are the central one and the two contiguous to it on either side. Whereas the heaviest grains are in the lower half of the ear, those of greater density and viability are in the middle zones.

The *vigour* is expressed by the live weight of the plant minus the weight of the grain from which it sprung. For the whole ear the averages of the 20 varieties or crosses tested (see Table I) were (in grams): — 2.277, 3.050, 2.082, 0.356, 2.744, 1.339, 2.374. 2.134, 2.105, 1.911, 1.155, 2.447, 1.098, 1.832, 2.326, 2.198, 1.777, 1.898, 2.272, 1.928; the averages for all the varieties and crosses for each of the 10 zones are: — 1.893, 2.125, 2.116,

2.133, 2.094, 2.064, 2.010, 1.966, 1.896, 1.503 ; the general average for all the varieties and crosses and for all the zones was 1.980. These results show that, as regards vigour, the best grains are those in the lower half of the ear, with the exclusion of those at the butt, which are very weak. The upper zone shows a uniform decrease in vigour from the 6th. zone to the tip.

There is a strong positive correlation between viability and vigour; the most viable seeds are the most vigourous, and the same naturally applies to the length of the seedling.

Variability is evidently correlated with weakness, but to determine to what degree, measurement of more than 2 500 seedlings must be taken. In other words, viability and vigour are negatively correlated with variability. A set of strong plants is more uniform than one of weak seedlings. Variability is greatly influenced by position on the cob ; this may be due to size as well as to maturity and nourishment of the grains.

A practical application of these results would consist in germinating a large sample, say 20 grains, from two rows upon opposite sides near the middle of the ear, selecting ears showing practically 100 % viability, and planting only grains from the middle of the ear, rejecting those from the butt zone and the four upper zones. This would be a more rigorous method than that, now in use, of discarding a few of the grains from the butt and tip of the ear.

272 – **Graft Hybrids Observed on Olive and Maple Trees in Italy.** — *L'Italia agricola*, Year LV, No. 1, p. 17 + 1 coloured plate. Piacenza, January 15, 1918.

The coloured plate shows a Cannellino olive tree with white fruit which when grafted on a Caiazzana olive tree with black fruit, produced white and black olives.

A variegated maple is also reported which, when grafted on a green maple, bore a branch having all the characters of the green maple and none of those of the variegated maple (1).

273 – **The Lulea Branch of the Svalöf Station, North Sweden.** — TEDIN, HANS, in *Sveriges Utsadesföreningens Tidskrift*, Year XXVII, Pt. 5, pp. 223-232. Malmö, 1917.

Svalöf and Luleå are separated by more than 10 degrees of latitude, and the physiographical conditions of each differ widely (2), especially where

(1) For other graft hybrids reported in Italy, see *B.* Sept., 1915, No. 928. (*Ed.*)

(2) The following facts show the differences between the climatic conditions of the s (Svalöf) and the north (Luleå) of Sweden. It is the custom, which, moreover, corresp fairly well to reality, to call, in these districts, "summer" the period when the average temperature is above 10° C, "winter" the period when it is below 0° C., and "autumn" "spring", the two intermediate periods. Taking this distribution as a basis, in nor Sweden, summer barely lasts two months, till the middle of August, whereas, in sou Sweden, it begins in the middle of May and lasts to the middle of October, *i.e.*, four m in all. The contrast between north and south is still more marked as regards the grow cultivated plants if the part of the year free from frosts is considered ; at Karesuande (No the last spring frost occurs, on an average, on June 15, and the first autumn frost on Aug so that the frost-free period hardly lasts 72 days ; at Stockholm, on the contrary, there ar months without any frost and, in the Island of Ven (Öresund), 6 months. (GUINCHA *Schweden*, Vol. 1, pp. 43-44, Stockholm, 1913).

owth of cultivated plants is concerned. The aim of the selector is to ite in one variety the characters "intrinsic yield" and "resistance to e most unfavourable meteorological phenomena" in a given locality. the intensity and distribution of the meteorological phenomena at Sva- and Luleå differ, it follows that varieties selected at Svalöf do not stand e same chance of success when introduced into Norrland. Experiments this subject gave absolutely negative results and it was, therefore, de- ded to form a special centre of selection for the north of Sweden — the leå branch Station.

EARLINESS. — All crops, especially cereals, in proportion as they ow further south, have a shorter period of growth which allows the nt to attain and exceed the ripening stage during the short summer. hat degree of earliness is required for the conditions found in Norrland? was thought possible to solve this question by using in selection va- ties from the northern districts, but it was soon seen that the place of gin is no guarantee of succees. Thus, for example, among the barleys own in the Norrland aree arly and late varieties. As a whole these varieties swer fairly well to the average climatic conditions and annual varia- ns, but, when separated and grown in pure lines, they may give negative ults. The variety No. 01243, a six-rowed barley, isolated at Svalöf m material sent from Luleå, when introduced into Norrland, proved late, ripening about a week after the local types. Nos. 01201 and 01222, -rowed barleys from Dalarne (central Sweden), on the contrary, proved Norrland, as early as the northern types. This may be explained by the t that every variety transported from one district to another shows endency to adapt itself to the new conditions by developing the neces- y characters. In southern Sweden the earliest forms of a given type d to decrease their degree of earliness, or to make it disappear altogether, reas it is very difficult to show very small differences, of two days for mple, differences which, in the north, corresponding to the limits of tribution, are of special importance, for two days more or less for a cer- n variety may make all the difference between ripening and not ripening. What has been said for earliness also applies to resistance to cold and eases.

CHARACTERS OF THE STRAW. — In Norrland growth is even more rapid regular than in the southern districts; the barley No. 01201 which, at löf, has a short stem, when sown in the north has a much longer stem, e subject to lodging. This modification, however, is not equal and pro- tionate for all varieties. Thus, for example, Findelen No. 0161 and 0164 (from plants gathered by the author at Findelen, near Zermatt, tzerland, at an altitude of about 6890 feet) developed culms of equal th both at Svalöf and at Luleå (length of culm about 2 feet). In order ass a just opinion on the character of the straw, experiments must be ied out in the district to which the variety is destined.

GRAIN YIELD. — The earliness, structure of the culm, resistance to and disease, which, as has been seen, vary with the environmental ditions, have a marked influence on the yield, so that even the charac-

ter " productivity " changes in different places. Earliness does not suffic to guarantee the strength of the yield at higher latitudes. A striking exampl of this is given by the very early six-rowed barley, Svalöf No. 01201. Du ing the years 1894-1904 this barley gave an average of 19.11 cwt. per acre a yield much below that of the Chevalier variety, 23.57 cwt. per acre. Th may be explained by excessive earliness (in the south at least) accompanie almost always by decreased productivity. If, however, 19.11 cwt. a not much at Svalöf, they represent a fairly good harvest in Norrland. A tempts have been made to introduce the barley 01210 in Norrland, bu although it was sufficiently early, the results as regards yield of grain wer far from encouraging.

The attempts to introduce into the northern districts types select at Svalöf go back to 1904, the year in which a series of comparative tests w 37 varieties of barley, 21 six-rowed and 16 two-rowed, was carried out Luleå.

As regards two-rowed barleys, repeated attempts made even with very early varieties, such as 0116 from Westergotland, 0161 and 0164 fr Findelen (Switzerland), were all completely negative. On the other han among the numerous varieties of six-rowed barley studied repeated were distinguished 01209, 01222 and 01225, fairly early and good produce 01209 at least, also having a large, well-formed caryopsis. The vari 01206 from Dalarne deserves special mention. AXEL ULANDER states th in 1908 this variety was still earlier than the very early native barle of Joukasförvi and Pasala. In spite of these few exceptions the Sval varieties have gradually had to give way before those selected at Lul natives of the Norrbotten coast, or the province of Tornea, or else collect from the Luleå district.

274 – **Experiments in Field Technic in Rod Row Tests.** — HAYES, H. K. and ARNY, A in the *Journal of Agricultural Research*, Vol. XI, No. 9, pp. 399-419. Washington, Nove ber 26, 1917.

The lack of uniformity in selection methods sometimes makes it dif cult to compare the results obtained by different workers. While the va nature of the investigations excludes the use of exact rules, as in chemist and physics, it is, nevertheless, possible to standardise the methods so to decrease errors in the estimation of biometrical data.

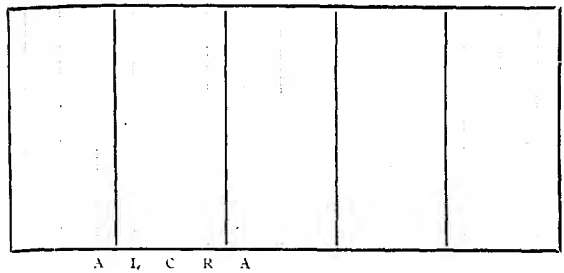
Where cereals are concerned, the size and shape of the plots, the com petition between them or their reciprocal action, soil heterogeneity, a all factors which have a considerable influence on the yield, and make difficult to estimate, because many of the figures are not strictly compa able. The authors have attempted to find a method to reduce these source of error to a minimum by a series of field experiments with barley, oa and wheat, which aimed at determining: —

1) The effects of competition between adjacent rows of cereals the same and of different varieties.

2) The planning (length, spacing, number of rows) which will mo effectually reduce to a minimum the effects of competition.

3) The number of times an experiment must be repeated to elimin-
e errors due to heterogeneity of soil.

Each of the experimental plots, adjacent one to the other, contained
rec 18-feet rows of cereals. The rows were 1 foot apart. In other words
ere were two border rows, one at the left (L), the other at the right (R),
d a centre row (C.), This arrangement is shown for one plot in the
llowing figure, which also includes the adjacent rows (A) of the two
ots on either hand.



A. — EFFECT OF THE HEIGHT OF THE ADJACENT LINES ON THE YIELD
F THE BORDER LINES OF ANOTHER VARIETY OF THE SAME SPECIES. —
here was one plot for each variety, arranged as described above. At
arvest time 1 foot was discarded from each row, reducing the length con-
dered to 16 feet.

To compare the *yield in grain* the following method was adopted; —
the left (L) border row yielded more than the right (R) border row, the
ult was considered *positive* and the difference expressed in + bushels
r acre; if the right border yielded the most the result was considered
gative, and the difference expressed in − bushels per acre.

The height of rows adjacent to the border rows of another plot were
mpared in the same way. If the variety near the left border was higher
an the variety near the right border, the result was *positive*, expressed
+ inches and centimetres; in the opposite case the result was *negative*,
pressed in − inches and centimetres.

With the results obtained tables where drawn up showing the correla-
n between *difference in yield* and *difference in height*, such as the follow-
g (see p. 306), concerning barley.

The figures given in this table made it possible to calculate (by
AVENPORT'S formula) a very high negative coefficient of correlation:
$r = -0.519 \pm 0.065$. The height of the rows of barley adjacent to
e border rows of a neighbouring plot thus has a decided influence on
e yield in grain of these border rows; the greater this height the lower
the yield.

The same applies to winter wheat, where $r = -0.337 \pm 0.097$.

There is, however, but a very slight negative correlation or even a
ghtly positive relation in oats and spring wheat.

Correlation between the difference in yield between the border rows of one variety and the difference in height of adjacent lines of other varieties.

Difference in yield of a border rows of the same variety (**bushels per acre**)

Difference in height of adjacent rows (in cm.)	— 9	— 7.5	— 6	— 4.5	— 3	— 1.5	0	+ 1.5	+3	+ 4.5	+ 6	+ 7.5	+ 9	
— 25							1			1				1
— 20							1		1			1		1
— 15								1		1		1		1
— 10					•	1		1	2	1		1		6
— 5					1	1	1	1	2	1			1	8
0			1	1	2	1	3		3	2				13
+ 5	2				2	3		1	1	1				10
+ 10	1	1					1							3
+ 15						1			1					2
+ 20					1			1						2
+ 25					1									1
+ 30				1	1									2
	3	1	2	3	8	7	7	5	10	7	0	3	1	57

The figures in the squares within the border represent the number of varieties showing such or such a combination between *difference in yield* and *difference in height*. The tota of these figures for each class are given outside the border on the right and at the botto and give a total of **57** varieties, shown in the right-hand bottom corner.

B. — EFFECTS OF THE ADJACENT LINES ON THE YIELD OF THE BORDE ROWS OF A DIFFERENT VARIETY OF THE SAME SPECIES. — These effects we determined as in the preceding case. The results show them to be less th the effects produced by the height of adjacent lines. The negative coef cient of correlation was again highest for barley $-r = -0.394 \pm 0.07$ about 6 times the probable error, followed by that of spring whe $-r = -0.290 \pm 0.087$. The other cereals had very low *positive* corr lations, except in the case of winter wheat, where $r = +0.315 \pm 0.09$ These positive coefficients might be due to soil heterogeneity.

C. — VARIABILITY OF BORDER ROWS, CENTRE ROWS AND THREE-ROW OTS OF CONTROL PLOTS. — The cereals studied are Haynes Bluestem heat, Turkey winter wheat, Ligowa oats and Manchuria barley. The order rows were found to vary much more than the centre rows, as the llowing figures, collected at the Minnesota Plant Breeding Nursery and arm Crops Section, show,

Cereal	Experiment field	Difference between coefficient of variability of border and central rows
aynes Bluestem whe t	Plant Breeding Nursery	2.90 ± 1.788
	Farm Crops variety test	1.35 ± 1.390
urkey winter wheat	Plant Breeding Nursery	2.74 ± 1.509
	Farm Crops variety test	0.94 ± 1.838
igowa oats	Plant Breeding Nursery	3.93 ± 1.230
	Farm Crops variety test	2.64 ± 1.613
anchuria barley	Plant Breeding Nursery	10.91 ± 4.208
	Farm Crops variety test	3.63 ± 1.386

The greatest differences are between barley, then between oats; they e but slight in spring and winter wheat.

On the other hand, a comparison between the coefficients of variability yield between the centre rows and the three row control plots gave the llowing results: —

Oats. — Negative differences, *i. e.* the yield of the centre rows varies s than that of the three-row plots.

Barley. — Very slight positive differences: — 0.55 ± 2.596 and 8 ± 0.993.

Winter and spring wheat. — Marked positive difference: — 1.65 ± 1.313 d 2.94 ± 1.699 for the first, and 0.61 ± 1.215 and 2.95 ± 1.535 for the ond.

In wheat, therefore, the average yield of the three-row plots varies s than that of the centre row, but the difference is not sufficiently great justify the extra labour which would be required to compute the yield the two border rows apart from that of the centre row.

From the results obtained the following conclusions were deduced: —

1) There is marked competition between rows 1 foot apart. In ection work, therefore, it is best not to sow only one row per ear, but to sow ree-row plots, as the two border rows have a protecting action.

2) In calculating the yield it is unnecessary to consider all the three ws, but time and work may be saved by considering the centre row only its variability is almost equal to that of the three rows together.

REPETITION OF TESTS IN ORDER TO REDUCE THE ERRORS DUE TO SOIL TEROGENEITY. — In the experiments described the control plots were

also used to study the efficaciousness of such repetition. Three repetitions reduced error by 25 to 50 % ; 9 to 12, reduced the error to a minimum, making them almost negligeable.

275 – **Correlations Observed in Continuously Cropped Barley, in U. S. A.** – See No. 289 of this *Review*.

276 – **A Method for Determining the Percentage of Self-Pollination in Maize.** – WALLER, A. E., in the *Journal of the American Society of Agronomy*, Vol. IX, No. 1 pp. 35-37. Lancaster, Pa., January, 1917.

In the maize endosperm which results from fusion of the second nucleus of the pollen grain with the two polar nuclei, the yellow colour is dominant to the white. If, therefore, a white variety is fertilised with the pollen of a yellow variety, the resulting ears are hybrid, certain grains having the dominant yellow colour of the male parent, in accordance with the phenomenon called " xenia " (1) by FOCHE.

The author used this phenomenon as an indicator to estimate indirectly the degree of self-fertilisation in maize, applying it as follows : — in a field of yellow corn he placed, here and there, two or three plants of white maize. At the time of tasselling two of the three plants in each hill of white maize were detasseled ; the third plant served to measure the degree of self-fertilisation on the basis that the white grains would be self-pollinated, the yellow grains the result of cross-pollination (xenia).

The varieties used were Reid's Yellow Dent and Wing's Hundred-Day White, which are particularly well adapted to cross-fertilisation since they flower about the same time. Of 36 ears, an average of 5.13 % were self-pollinated, but, for the reasons given in § 3, this does not represent the percentage of self-pollination which might take place under field conditions.

It should be remembered that : —

1) It is not always easy to distinguish the white grains from the yellow grains, which may be very pale. This is perhaps due to the formation in the endosperm of only *one set of yellow determinants*, brought by the second nucleus of the pollen grain, as against that of *2 sets of white determinants* contained in the double endosperm nucleus.

2) If, instead of comparing only 2 characters of the endosperm for colour (white and yellow, that is, one pair), the author had compared 2 *pairs* of characters, concerning, for example " colour " and " sugar content ", the classification of the grain would have been greatly facilitated. It is, however, difficult to obtain sweet white varieties which flower at the same time as yellow field corn, and to do so a series of plantings would be necessary.

3) In the field the percentage of self-pollination is influenced by ex-

(1) When a female flower is fertilised by the pollen of another variety or species, the resulting fruit may show, in its endosperm, besides the embryo of the hybrid, also the characters belonging to the fruit of the male parent. In his work called *Die Pflanzenmischlinge*, FOCHE calls this phenomenon *xenia*. — See also BAUR, ERWIN, *Einführung in die experimentelle Vererbungslehre*, p. 243. Berlin, 1911. (*Ed.*)

ture, spacing of rows, the direction and strength of the wind, atmospheric isture, so that the sources of error can only be eliminated by repeating experiments during several years.

- **The Relation of the Vigour of the Maize Plant to Yield.** — GRANTHAM, A. E., in the *Journal of the American Society of Agronomy*, Vol. IX, No. 7, pp. 340-343. Washington, D. C., October, 1917.

The experiments described were carried out at the Delaware Agricultural Experiment Station, Newark, to ascertain the relation of the vigour the maize plant to its yield in grain. Of two plants grown in the same , one was much stronger and vigorous than the other. About 100 such nts were chosen and grown under identical conditions, the hills thinned, the stronger plant removed in 50 cases and the weaker one in the other cases.

The two groups were distinguished by : — *a*) a considerable difference the date of tasseling (August 5-12), the weaker plants being much later in the others ; *b*) height, measured every 8 days after thinning, from June to September 18. The extreme measurements were : — on June 25, 4.7 d 9.2 inches, and, on September 18, 98.0 and 107.3 inches respectively the weak and strong plants.

The following table gives the most important results of the experiments : —

Distribution of ears from strong plants and from weak plants.

Weight of ear, grams	Number of ears		Weight of ear, grams	Number of ears	
	Strong stalks	Weak stalks		Strong stalks	Weak stalks
0- 50	0	5	300 350	11	4
50-100	0	5	350-400	8	1
100-150	2	10	400-450	2	0
150-200	4	9	450 500	3	0
200-250	7	8	500 550	1	0
250-300	8	6			
				46	48

This table shows that strong stalks produce no ears under 100 gm. in ight, whereas, of 48 weak stalks, 10 produced ears weighing less than 0 gm. More than half the ears from strong stalks weighed more than 0 gm., while $^2/_3$ of those from weak stalks weighed less than 200 gm. The ong plants are also distinguished by a higher yield in grain (221.7 gm. r strong stalks, 109.6 gm. for weak ones), the weight of the cob (41.7 and 38.8 gm.), and a lower percentage of cob (19 and 24% respectively).

There is, therefore, a positive correlation between vigour and yield (1).

(1) The total weight of the plant is in direct ratio to the total weight of the caryopses also FRUWIRTH, C., *Die Züchtung der landwirtschaftlichen Kulturpflanzen*, 2nd. Ed., l II, p. 9, Berlin, 1900). (*Ed.*)

278 - Correlations between Ear Characters and Yield in Maize (1). — LOVE, H. H. and WENTZ, J. B., in the *Journal of the American Society of Agronomy*, Vol. IX No. 7, pp. 315-322. Washington, October 22, 1917.

A summary is first given of the results obtained by workers who, in selection for a given character, chose the two extremes, and sought to establish the relationship between this character and the yield (2). The author then describes his own experiments (at the Department of Plant Breeding, Cornell University, Ithaca, N. Y.) in which he chose, for each character studied, ears near the average type. The maize used was Cornell No. 12, a yellow dent variety selected from the Funk Ninety Day variety. In a table are shown the correlations obtained for all the characters in each of the 5 years during which the experiment lasted.

Below are given, in Table I, the general averages for the characters studied during the 5 years 1910-1914, and, in Table II, the mean percentage of grain in the ears of a few of the highest and lowest classes with the mean yield of these classes.

TABLE I. — *General averages of the characters studied.*

Ear characters correlated with yield per stalk		Average (1910-1914)
Length	cm.	21.382 ± 0.04
Average circumference	cm.	15.278 ± 0.02
Ration of tip to butt circumference		0.859 ± 0.001
Average circumference of cob	cm.	9.289 ± 0.01
Weight	gm.	273.048 ± 0.97
Percentage of grain	%	85.252 ± 0.07
Average weight of kernels	gm.	0.283 ± 0.00
Number of rows		17.004 ± 0.06
Average length of kernels	cm.	1.314 ± 0.00
Average width of kernels	cm.	0.798 ± 0.00
Yield per stalk	lbs.	0.727 ± 0.00

(1) See also *R.* February 1918, No. 148. (*Ed.*)

(2) WILLIAMS, C. G. (Corn Experiments, *Ohio Agricultural Experiment Station Bulletin* 282, 1915), selected ears for the maximum and minimum extremes of the characters length of ear, shape of ear, filling of tip, indentation of kernel, weight of ear and percentage of grain. In selecting long and short ears he obtained a difference of only 1.39 bushels per acre in a 7 year average yield in favour of long ears. In selection for shape of ear, tapering ears surpassed cylindrical ears in average yield during a 9-year period by 1.65 bushels per acre. Eight years selection of bare and filled tips gave an average difference of 0.34 bushel per acre in favour of filled tips. Seven years' selection of rough and smooth dented ears gave an average difference of 1.76 bushels per acre in favour of the smooth type. Seed ears averaging 88.16 % of grain gave a 6-year average yield of 64.64 bushels per acre as compared with 65.06 bushels from ears averaging 76.38 % of grain.

HARTLEY, C. P. (Progress in Methods of Producing Higher Yielding Strains of Corn, *U.S. Department of Agriculture Yearbook*, 1909, p. 309), tabulated the yields of 4 varieties for 6 years, including 1000 ear-to-row tests. He found no relation between the characters of seed ears and yield.

ABLE II. — *Mean percentages of grain in the ears in a few of the highest and lowest classes, with the mean yields of these classes.*

Year	High classes		Low classes	
	Percentage of grain	Yield per stalk, pounds	Percentage of grain	Yield per stalk, pounds
910	87.074	0.822	81.676	0.859
911	88.563	0.624	79.375	0.677
912	87.158	0.672	80.750	0.738
913	88.447	0.602	80.714	0.817
914	87.235	0.651	82.750	0.645
Average	**87.596**	**0,698**	**81,853**	**0,753**

MONTGOMERY, E. G. (Experiments with Corn, *Nebrasa Agricultural Experiment Station*, *lletin* 112, 1909), during many years selected ears for the characters shape of ear, shape of nel and size of ear. He concluded the results were slightly in favour of long ears; the size the ear depends too much on environment to be of any importance; a medium depth of ker- l is to be preferred.

PEARL, RAYMOND and SURFACE, FRANK M. (Experiments in Breeding Sweet Corn, *Maine gricultural Experiment Station, Bulletin* 183, 1910), carried out, from 1907-1909, a large num- r of ear-to-row tests with sweet corn. One of their conclusions is that there is no relation etween the external seed characters and yield in sweet corn.

SCONCE, H. J. (Scientific Corn Breeding, *Proceedings of the American Breeders' Association*, ol. VII, p. 43, 1911) tested Reid Yellow Dent and Johnson County White maize for 5 years. He und that ears of these varieties with 18 and 20 rows of kernels gave better yields than those ith more than 20 or less than 18 rows. Averaging the results of 4 years he found that, with eid Yellow Dent, the best yields were obtained with kernels having small germs, and with hnson County White, with kernels having large germs. In correlating yield with shape of rnel he found that, in both varieties, square-shouldered kernels showing a small space be- ren the rows at the crown and tip gave the best yields.

MCCALL, A. G. and WHEELER, C. S. (Ear characters not correlated with yield in corn. *ırnal of the American Society of Agronomy*, Vol. V, p. 117, 1913), of Ohio State Uni- rsity, calculated the correlations between a few ear characters and yield and obtained the llowing results:

Characters correlated with yield	Coefficients of correlation	
	Series 1	Series 2
ngth of ear	0,0586 ± 0,0296	0,1017 ± 0,0651
eight	— 0,0270 ± 0,0262	0,0866 ± 0,0056
rcumference	— 0,0068 ± 0,0287	0,1803 ± 0,0636
nsity	0,0272 ± 0,0203	— —

The ears used in this work had not been selected for the characters used in the correla- ns.

CONCLUSIONS. — 1) The characters, length, ratio of tip circumference to butt circumference, average circumference of cob, weight, average weight of kernels, number of rows of kernels and average length and width of kernels, do not show correlations significant enough to be of value in judging seed maize.

2) There is a slight negative correlation between percentage of grain in the ear and yield, implying that ears containing a low percentage of grain may yield higher than ears with a high percentage of grain.

3) The average circumference of the ear is the only character showing any significant relation to yield.

4) The external characters of the ears cannot serve as a basis for the choice of high yielding ears. The points on a show card are of no value for selecting seed ears, and apply exclusively to show purposes.

5) The only basis for selecting high-yielding seed maize is the ear-to-row progeny test.

LOVE, H. H. (The Relation of Certain Ear Characters to Yield in Corn, *Proceedings of the American Breeders' Association*, Vol. VII, p. 29. Washington, 1912), obtained the following correlations in experiments carried out over two years:

Ear characters correlated with yield per stalk	Minnesota No. 13		Funk Ninety Day	
	1909	1910	1909	1910
Length	— 0.059 ± 0.076	0.241 ± 0.064	0.300 ± 0.061	0.058 ± 0.0
Weight	0.094 ± 0.076	0.015 ± 0.068	0.323 ± 0.060	0.097 ± 0.0
Number of rows	0.260 ± 0.072	— 0.127 ± 0.067	— 0.061 ± 0.069	— 0.034 ± 0.0
Weight of kernels	—	0.028 ± 0.068	—	0.043 ± 0.0
Ratio of tip circumference to butt circumference	—	— 0.162 ± 0.066	—	0.014 ± 0.0
Percentage of grain	—	— 0.177 ± 0.066	—	—

Thus the only characters showing any considerable correlation are length and weight ear. Of the 8 correlations obtained for these two characters in the two years, two are abo five times their probable error, so that these correlations can hardly be considered sig ficant. (See also *B.* May 1912, No. 491).

CUNNINGHAM, C. C. (Relation of Ear Characters of Corn to Yield, *Journal of the Americ Society of Agronomy*, Vol. VIII, p. 188, 1916), of the Kansas Experiment Station, studied t relation of the ear characters to yield in a number of varieties. He found some variation l length of ear in the different varieties. In the small varieties the long ears yielded a little b ter than the medium and short ears, but this did not apply to the larger varieties. There w no significant difference in the averages for all varieties. Ears with small circumference o yielded the large ears. There seems to be no relation between the filling out of the tips of t ears and yield. Smooth ears out-yielded the roughly dented ears. Ears with low percentage grain yielded slightly higher than those with the higher percentages of grain. Ears with and 18 rows of kernels generally gave the highest yields, though, in this character, there wa difference in varieties.

9 – **Breeding Sweet Corn Resistant to the Corn Earworm.** — COLLINS, G. N. and KEMPTON, T. H., in the *Journal of Agricultural Research*, Vol. XI, No. 11, pp. 544-572. Washington, December 10, 1917.

In the south of the United States and throughout the American opics the production of sweet maize is greatly hampered by the ravages of ıe maize earworm (*Chloridea obsoleta* Fab., of the Noctuidae family), hich are so serious that, in some districts, the place of sweet maize has een taken by the more resistant field varieties.

In order to unite in a new variety the character "sweet grain" of veet maize and that of "resistance to earworm" of field maize, a series f hybridisation and selection experiments were carried out from 1912 to 916 at Victoria (Tex.), Chula Vista, near San Diego (Cal.) and Lanham Md.). Crosses were first made between the three commercial varieties of veet corn, Stowell's Evergreen, Early Evergreen and Early Cory, and two ırieties of field corn, Brownsville and Marrainto. Brownsville was selected r its resistance to earworm; Marrainto, a variety from northern Mexico, ıs rather thicker and harsher husks than those of Brownsville. From nong the hybrids obtained the four following were chosen:

Ph 75 (Brownsville × Early Cory) Ph 79 (Stowell's Evergreen × Brownsville)
Ph 77 (Early Evergreen × Brownsville) Ph 80 (Marrainto × Early Evergreen).

From the beginning of the experiment the four characters considered important in resistance to earworm were: —

1) *The distance which the husks extend beyond the tip of the ear;* as the rvae usually enter the ear from the tip of the shoot it is advantageous to crease the distance they must travel.

2) *The thickness of the cover of the husk*; as the larvae sometimes ıter the ear through holes in the husk a thicker cover might hinder them.

3) *The texture of the husks*; in most sweet varieties the husks are latively soft and smooth, while in field varieties they are firm and rough, metimes even covered with firm spicules making their surface like sand-per. This character might prevent the insects from eating through the sks.

4) *The husk leaves;* it was throught that ears without husk leaves ght be less attractive to the moths.

The ears from the F_1 contained a mixture of sweet and horny seeds. 1914 the sweet seed from selected ears of each of the four above-mentioned brids were sown in separate rows at Lanham, one row for each ear. Pol-ations were then made of plants of similar appearance, usually within the ne row, the characters described being recorded for each plant. Pre-ence was given to plants with long husks and few husk leaves, but her types, including a few that appeared inferior in worm-resistant cha-cters, were not excluded. In 1915, 14 ears were selected and the grain om them sown at Chula Vista, where the earworm does more serious da-age than at Lanham.

When the hybrids obtained in 1915 at Chula Vista were compared th other varieties of sweet maize growing in the neighbourhood, the hy-ids were found to have suffered less than the other varieties. All condi-

tions being equal, and the effect of competition in adjacent lines (1) being taken into consideration, some lines showed greater resistance than others thus, the hybrid Ph 124 (Stowell's Evergreen × Brownsville) was 7½ times more resistant than Ph 125 (same cross). This proves that *different plants from the same ear are distinguished by a special degree of resistance*.

In 1916, 35 rows were planted at Lanham, distributed as follows: —

14 rows of the 1915 hybrids.
9 from ears obtained by hand pollinations within the rows of the 1915 row
8 rows from ears obtained by crosses between the rows in 1915.
2 rows of F_1 crosses between 1915 lines and Hopi maize
1 row of Oregon Evergreen (P 129,) a commercial variety of sweet maize
1 row of New Century Wonder (P 125), a commercial soft variety sold as table maize

The results confirm those of 1915. Ph 124 retained its superiority, showing the *character "resistance to earworm" to be hereditary*. Moreover, the degree of immunity may increase from one generation to the other as is shown by the correlation 0.66 ± 0.09 for damage done by earworm. On the other hand, three varieties of sweet maize used for comparison, Oregon Evergreen, one of the most resistant commercial varieties of sweet maize and two Hopi hybrids, Ph 137 and Ph 141, were seriously injured by the parasite.

CHARACTERS CORRELATED WITH RESISTANCE : —

1) *Damage*, expressed by a scale from 1 to 10, where 10 expresses complete destruction of the ear.

2) *Number of larvae.*

3) *Damage per larva.*

4) *Prolongation of husk*; the distance from the tip of the ear to that of the husk expressed in centimetres.

5) *Length of ear.*

6) *Length of husks.*

7) *Number of husks.*

8) *Number of layers forming the husk.*

9) *Number of days from planting to silking.*

10) *Maturity*; the proportion of opaque to transparent endosperm estimated in a section of the grain, according to a scale of from 6 to 15 ; below 6 the grain is not marketable.

11) *Number of days from silking to harvest.*

12) *Husk leaves* ; the development is in accordance with a scale of 1 to 10.

13) *Number of rows.*

The correlation of the characters *prolongation, length of husks, number of layers, days to silking, to damage* are expressed by coefficients equal to or above 0.35. There is positive correlation between

Prolongation and *Length of husks.*
Length of husks and *Length of ear.*
Number of husks and *Number of layers.*

(1) See No. 274 of this Review. (*Ed.*)

Number of layers and *Days to silking*.
Days to silking and *Maturity*, *Days from silking to harvest*, *Husk leaves*.
Maturity and *Days to harvest*, *Husk leaves*.

These correlations must be borne in mind so that an eventual immunis- effect may not be wrongly attributed to one of a pair of correlated cha- ters.

ANALYSIS OF RESULTS. — *Prolongation of husks.* — One of the chief fferences between sweet maize and field maize is the greater length of e husks which greatly exceed the lip of the ear in the latter ; the larvae the earworm must thus travel a greater distance to reach the tip. This plains the greater resistance of the field variety. A correlation between *mage* and *length of husk* is, therefore, to be expected. Such a correlation 0.71 ± 0.06 is, indeed, found, whereas the relation of *regression of dam- e* (1) *to length of husk* is expressed by the coefficient 1.02, *i. e.* an increase of m. in prolongation may save 1 % of the crop. Amongst 14 progeny with average prolongation of 2.9 cm. there was a loss of 10 %, and among with an average prolongation of 7.7 cm. the loss dropped to 5 %. In her words, an average increase of 4.8 cm. in prolongation was accompan- by an average reduction of 5% in damage (or about $^1/_{100}$ per centimetre).

Number of layers and number of husks. — The coefficient of correla- n between this character and damage is high — 0.52 — but as only 4.5% the larvae enter the ear by penetrating the husks, there cannot be said to any direct relation as to cause and effect between the number of layers l damage. The protective effect of the layers is also partly due to *ther character* correlated with thickness which has not been considered these experiments (partial correlation).

Husk Leaves. —The larger the leaves the larger the space over which moth can deposit eggs. The positive correlation between damage and sk leaves is 0.31 ± 0.11 In selection, therefore, forms with very large husk ves should be avoided.

(1) When the coefficient of correlation between 2 characters and the standard deviation ich is known the *coefficient of regression* may be easily calculated. For example, to obtain coefficient of regression of the weight of the ear as related to its length, the coefficient of elation between *weight* and *length* is multiplied by the standard deviation from the average ght, and the product divided by the standard deviation from the average length, using the mula $r = \frac{\sigma w}{\sigma L}$, where W represents the weight in ounces and L the length in inches. Similarly, to calculate the coefficient of regression of the length as related to the weight, formula $r = \frac{\sigma L}{\sigma W}$ is used. Supposing, for example, that the coefficient of regression he weight as related to the length is 2.03 and that, in certain groups of ears in a field, the iation from the average length of the group in relation to the average length of the crop nches, by multiplying this deviation by the coefficient of regression, these ears may be said eigh 2 × 2.03 = 4.06 ounces more than the average weight of the ears of the crop.

The coefficient of regression thus gives a specific relation between the standard deviation correlated characters, so that, if the standard deviation of one of them be known, it is to calculate the standard deviation of the other. — Cf. DAVENPORT, E., *Principles of ling*, pp 166-368. (*Ed.*)

Number of larvae and damage per larva. — These values are low in resistant lines. As the number of larvae depends greatly on the degree of attraction of the plant for the female moth, it may be assumed that the plants avoided by the moths are those most distasteful to the larvae. It is probable that this agreement between the instinct of the larva and the moth depends less on the morphological characters of the plant than on chemical differences, probably on the presence of some volatile substance distasteful both to the larva and to the moth. We have, therefore, one of the characters which have not been considered in these investigations although it is closely correlated with damage.

Other characters. — The coefficients of correlation are low and of no importance in practical selection.

CONCLUSIONS. — 1) An increase in the length and thickness of the husk covering, and a reduction of the husk leaves increase resistance to earworm.

2) By crossing sweet maize and field maize varieties, the character "sweet grain" and "resistance of the ears to earworm" may easily be united in one variety in ever-increasing proportions.

280 – **Correlations Observed in Maize Grains, in U. S. A.** — See No. 271 of this *Review*.

281 – **Inheritance of Abbreviation of Growth in the Cultivated Carrot and Beet.** DANIEL, LUCIEN, in *Comptes rendus des Séances de l'Académie des Sciences*, Vol. CLXV No. 25, pp. 1012-1014. Paris, December 17, 1917.

In 1916 the author described his studies on certain nutrition modifications caused by the sea climate and sandy soil in plants transferred from Rennes (Ille-et-Vilaine) to Erquy (Côtes-du-Nord), by the sea (1). He showed that most of these variations were not hereditary, but disappeared with inland cultivation. He extended his observations to the study of the inheritance of other phenomena which appear to be more frequent on the coast, particularly the inheritance of abbreviated growth in carrot and beet, which sometimes give annual plants of no, or of only very minimum, utilitarian value.

(1) DANIEL, LUCIEN, Cultures expérimentales au bord de la mer, in *Comptes rendus des Séances de l'Académie des Sciences*, Vol. CLXIII, No. 18, pp. 483-486. Paris, Oct. 30, 1916.

The author summarised as follows the results of his experiments carried out during years at Erquy : —

1) In 15 years the plants transferred from Rennes to the coast at Erquy, acquired no lophytic characters although subjected to the influence of fog and occasional watering wi salt water.

2) The only distinct variations were those caused by the very marked oscillations the water (quantity, quality and salt content), which caused dwarf and giant plants and the intermedite stages. This actions is entirely transitory, both in the experimental pla themselves and in their descendants. It does not appear to be hereditary so far as c judged from the negative experiments and their short duration (15 years) as compared w repeated action during many centuries. Giant or dwarf plants, so common on the sea co according to the degree of moisture at the station, rapidly lose their peculiar characters land, thus again confirming the non-inheritance of these phenomena.

His experiments, which are still being continued, were carried out simultaneously at Rennes and at Erquy and gave the following results: —

1) The abbreviation of growth is partially hereditary, to a degree varying with the conditions of cultivation in a first generation ;

2) The sensibility to the variation is specific and greater in the variety of carrot studied than in that of beet ;

3) The abbreviation of growth varies with the individual and may be accompanied by unexpected variations showing that the stability of the race has been deeply shaken ;

4) Care must be taken not to use seed of annual carrots and beets ; the mixing of such seeds with pure ones should be suppressed.

32 – **The Selection of Some Varieties of Swede Resistant to *Plasmodiophora Brassicae*, in Denmark.** — CHRISTENSON, C. I., in *Tidskrift for Planteavl*, Vol. **XXVI**, Part. 1, pp. 68-82. Copenhagen, 1917.

The English variety Pioneer, of Driffield, Yorkshire, is known to be resistant to the attack of *Plasmodiophora Brassicae*, which causes great damage to swedes in Denmark every year. For this reason, the discovery of two new varieties of swede more resistant than Pioneer to the disease, is worthy of special notice.

One was isolated from the type-variety Klank belonging to the " Trifolium " Society of Copenhagen ; the other came from the Studsgaard Experiment Station. The article describes the results of a series of selections carried out at Studsgaard during 1909-1916, with excellent results. In the autumn of 1908, the author collected 18 healthy, well-developed specimens from plots very badly damaged by *Plasmodiophora*. Some of these choice specimens went bad during the winter ; 11 remained and were planted in the spring of 1909, well isolated to prevent cross-fertilisation.

Sufficient seed was collected from 10 of the plants to allow study of the progeny. The aim was to ascertain whether resistance to *Plasmodiophora* is hereditary. Ten families were named, one for each seed plant : Langholm Fam. 1, Fam. 2, etc. The seed was sown on plots that had produced swedes for the two previous years that were badly attacked by *Plasmodiophora*. The results for 1910 are given in Table I. The progeny are divided into 3 groups: 1) perfectly resistant ; 2) slightly attacked, but the ' root ' retains its form and can be fed to cattle ; 3) badly attacked, the ' root ' being completely spoiled. Column 8 in the table shows the degree of intensity of the attack for each family, calculated according to the formula : $K = \frac{0 \cdot a + 1 \cdot b + 2 \cdot c}{n} \times 10$, where a equals the number of unattacked roots, b, the number of slightly attacked roots, c the number of badly attacked roots, and n, the total number $(a + b + c)$ of roots.

The progeny of 87 roots, chosen with no criterion of immunity, and crossing under similar conditions, and quite near to the experimental plots, were almost completely destroyed by *Plasmodiophora* : degree of intensity of the attack = 14. The attack was much reduced in the case of the 10 Langholm families coming from resistant plants ; the intensity being 4

(maximum) given by Fam. 1 and 2, and 0.4 (minimum) given by Fam. 4, which was also notable as being almost completely immune.

The 1912-1913 Experiments confirmed those of 1910. During this time, by means of continuous and minute selection in the Studsgaard experimental fields, some lines were isolated that had a high degree of resistance, as was shown by trials in 1914, 1915 and 1916.

TABLE I. — *Demonstration of the transmissibility of the character "resistance to Plasmodiophora Brassicae". 1910 results.*

	Number of roots per plot				No. of roots %				Kg. of roots per plot			
	immune	*slightly attacked*	*badly attacked*	Total	*immune*	*slightly attacked*	*badly attacked*	K = intensity of attack 0 — 20	*immune*	*slightly attacked*	*badly attacked*	*total*
Pioneer.	24.6	1.7	2.7	29.0	85	6	9	2	15.6	0.9	0.4	16.9
Bangholm (ordinary) . .	5.3	8.3	15.4	29.0	18	29	53	14	3.3	6.2	3.2	12.7
Bangholm, Fam. 1 . . .	21.4	3.3	3.3	28.0	76	12	12	4	13.8	2.9	1.2	17.9
» » 2 . . .	23.3	5.0	2.0	30.3	77	16	7	3	12.7	2.1	0.2	15.0
» » 3 . .	23.3	5.0	0.7	29.0	81	17	2	2	16.8	1.9	0.2	18.9
» » 4 . .	29.0	1.3	0.0	30.3	96	4	0	0.4	19.6	0.9	0.0	20.5
» » 5 . .	24.3	3.7	2.3	30.3	80	12	8	3	22.1	2.0	0.4	24.5
» » 6 . .	22.3	1.7	1.3	25.3	88	7	5	2	18.1	0.9	0.4	19.4
» » 7 . .	23.3	2.7	3.0	29.0	81	9	10	3	16.6	1.7	0.5	18.8
» » 8 . . .	23.0	3.0	2.7	28.7	80	11	9	3	18.6	2.2	0.5	21.3
» » 9 . . .	21.0	5.0	1.0	30.0	70	17	13	4	17.6	2.9	0.9	21.4

TABLE II. — *Table showing the degree of resistance of the progeny* (1916).

	Hundreds of roots per hectare					Number of roots %				
	immune	*slightly attacked*	*badly attacked*	*destroyed*	Total	*immune*	*slightly attacked*	*badly attacked*	*destroyed*	K = intensity of attack 0 — 20
Bangholm Fam. 4. . .	444	76	9	4	533	83	14	2	1	3
» » 25. . .	421	63	8	21	513	82	12	2	4	3
» » 19. . .	387	108	15	9	519	74	21	3	2	3
» » 21. . .	374	106	20	20	520	72	20	4	4	4
» » 26. . .	356	88	40	22	506	70	18	8	4	5
» » 3. . .	309	127	56	19	511	60	25	11	4	6
Bangholm, Pajberg III (ordinary type)	15	194	148	93	450	3	43	33	21	17

In Table II (1916), in order to find the value of K, the progeny are di-
ed into 4 groups: — 1) immune; 2) slightly attacked; 3) heavily attacked;
almost completely destroyed. The formula $K = \frac{0.a + 1.b + 2.c + 3.d}{n} \times 10$
sed, where d equals the number of plants entirely destroyed (a, b, e
n as in the preceding formula).

Among the new forms, Fam. 25 and 19 deserve attention both for
resistance and yield (see Tables II and III). They come close to
. 4, which, however, always maintains its first place. This shows the
ellent results obtainable by individual selection.

TABLE III. — *Data on the 1916 root crop.*

	Dry matter per hectare, in quintals	Roots per acre, in quintals				% of dry matter
		immune	*slightly attacked*	*badly attacked*	Total	
holm Fam. 4. . .	83.7	486	87	4	577	14.5
» 25. . .	80.6	506	76	2	584	13.8
» 19. . .	74.0	432	117	7	556	13.3
» 3. . .	73.7	304	120	24	508	14.5
» 26. . .	69.6	399	85	17	501	13.9
» 21. . .	67.9	363	93	12	468	14.5
holm Pajberg III (ordinary type)	49.0	13	271	99	383	12.8

- Flaxwilt: A Study of the Nature and Inheritance of Wilt Resistance. — TISDALE, W. H., in the *Journal of Agricultural Research*, Vol. XI, No. 11, pp. 573-605, plates 44-46. Washington, December 10, 1917.

The experiments described were carried out in February, 1915, at the versity of Wisconsin. Crosses were made between a variety of flax re-ant to wilt (*Fusarium lini* Bolley) — North Dakota Resistant 114, de-ated in the article as No.4 — with 3 other varieties more or less suscep-to the disease, namely, No. 3, from Dakota, No. 5, with white flowers Red Wing, Minn., No. 6, from Devil's Lake, N. Dakota., and the viour of the hybrids obtained observed.

Only one of the crosses, that between the resistant variety No. 4 and most susceptible variety, No. 3, gave results which could be explained Mendelian formula. The resistant plant was used as female parent, the progeny designated as 4 D 20, where 4 represents the strain, D the on which it was grown, and 20 the number of the female plant. The 26 F_1 nds thus obtained remained perfectly healthy, whereas the No. 3 con-plant wilted entirely. In the F_2, of 530 plants, 162 were resistant and wilted, giving a ratio which makes it impossible to attribute the cha-er "resistance to wilt" to one single factor. If, however, 4 factors concerned, these figures (or rather their halves, 81 and 184) are close

to the theoretical figures, 81 resistant to 175 susceptible, correspondi to the Mendelian ratio 1 : 2.16.

However, as has already been said, this cross was the only one the sults of which could be explained ; in all the others the ratio betwe resistant and susceptible plants varied so greatly that it could not be counted for by admitting a constant number of factors. In the F_1 w obtained both more or less resistant plants and very susceptible plants, b in most cases, intermediate forms, expressed by very varying factors. must be pointed out that some of the hybrids with the same degree susceptibility (percentage of dead plants at the end of the experiment) the susceptible parent plant sometimes showed a marked difference fr this parent as to the date of starting, rapidity and duration of the in tion ; in some plots of susceptible hybrids the first symptom of disease o began to appear when the control parent plants were already wilted l large extent.

It must be noted that the environmental conditions during the exp ments were far from uniform especially as regards the state of the so which was sometimes naturally and sometimes artificially infected, thus fecting the resistance of the plants. It seems possible that the compl phenomena observed in these hybridisation experiments may be explain by the specific action of external factors on resistance to wilt. The sistant strain No. 4 was selected to withstand the disease under norm environmental conditions. In this case the factors **A, B, C, D,** are sufficie to produce immunity, so long, of course, as they are homozygous (AA. BB CC, DD). When, however, extraordinary conditions (temperature, inocu lated soil) favourable to the growth of the parasite are artificially create the action of **A. B. C. D,** becomes insufficient, and part at least of the hybrid resistant under normal conditions, break up into resistant and susceptib plants. In such cases, to regain immunity, other factors, **E. F.** etc., mu be taken into cosideration. This has evidently not been done for stra No. 4, selected for growth under normal conditions. The factors in th line may be : — 1) entirely absent, 2) present singly, 3) present in combin tion, either homozygous or heterozygous. The differences in the resu obtained would be thus explained.

The wilting of the plants attacked is due to the combined action the following factors : — 1) destruction of the root system ; 2) use of t food and water supply of the plant by the fungus ; 3) more vigorous grow of the fungus and increased transpiration of the host plant due to a r in temperature ; 4) the possible production by the fungus of toxins injuri to the host protoplasm. What is the specific behaviour of the resist plants towards the pathogenic agent ? The mycelium penetrates the r hairs, epidermal cells, the stomata of seedlings, and perhaps also woun of both resistant and susceptible plants. In the latter it develops rapi killing the tissues, whereas, in the former, it is unable to penetrate tissues. This may be due to : — *a*) the permanent chemical composition the resistant plant may be injurious to the fungus, *b*) the protoplasm the resistant plant may be more sensitive than that of the suscept

lant. thus reacting more readily in the production of the phenomena ausing wilting ; c) below and around the point attacked the cells of the arenchyma, which form a fourth layer, divide and thicken their walls ith a substance giving the suberin reaction ; the cork layer thus formed olates the infected zones, preventing further progress of the hyphae.

84 - **Selection of Pea-seed.** — BEVERLEY, J., in *The Journal of Agriculture, New Zealand Department of Agriculture, Industries and Commerce*, Vol. XV, No. 4, p. 216. Wellington, New Zealand, October, 1917.

The experiments were carried out to ascertain whether the number f peas in the pod has any influence on the vigour and yield of the future rop. The results for the season 1916-1917 were : —

Variety	Number of peas in pod	Plant vigour expressed	Seed yield expressed
verley's No 1 pea.	Average : 8 or less	100	100
	Once selected : 10	105	140
	Twice selected : 10	105	156

The results are positive and clearly show the effect of selection. The eed from pods containing 10 produce better developed and more productive lants than those from pods containing 8 or less. The seed from the 1st. eneration of pods containing many peas gives a yet higher yield in the 2nd. eneration.

85 - **Asparagus Selection in Massachusetts, U. S. A.** — *Twenty-Ninth Annual Report of the Massachusetts Agricultural Experiment Station, Public Document* No. 31, pp. 23-24. Boston, January, 1917.

The asparagus selection work at the Concord Substation, Massachutts, is in charge of Prof. J. B. NORTON. Starting with the common commeral varieties he successfully isolated strains distinguished, not only by their igour, and the quality and quantity of their produce, but also by marked sistance to rust (*Puccinia Asparagi* D. C.).

For testing purposes were distributed : — in 1915, to 99 growers, 68 lots f roots of 50 each, and 217 ounce packets of seed ; in 1916, to 74 growers, 7 lots of roots of 100 each and 43 ounce packets of seed of the new varieties.

All the reports were favourable, both as regards the produce and the pidity and vigour of growth. In no case was rust reported, but, in view of ie relative freedom from rust attacks in 1915-1916, the results of further sts must be awaited before any definite opinion as to immunity to this isease can be passed.

86 - **Hybrid Chestnuts in the United States.** — MURRILL, W. A., in the *Journal of the New York Botanical Garden*, Vol. XVIII, No. 214, pp. 213-215. Lancaster, Pa., October, 1917.

The paper refers to certain chestnut hybrids obtained and cultivated y Mr. VAN FLEET in his experimental grounds several miles to the north-

east of Washington. The following lines were used for propagation and study: American chinquapin chestnut (*Castanea Chincapin* Hort. = *pumila*), Japanese chestnut (*C. japonica* var. *pubinervis* Makino), and Chinese chestnut (*C. chinensis* Hassk. = *C. sativa*).

CHINQUAPIN × JAPANESE. — Among the hybrids were found all the stages intermediate to the large, sweet chinquapin and the Japanese type with fruit fine, but of poor flavour and good only for cooking. The more chinquapin stock present, the better is the flavour. All these hybrids were immune from chestnut canker or blight (*Diaporthe parasitica* Murr.), and some produced excellent fruit.

CHINQUAPIN × CHINESE. — The use of the Chinese chestnut is to be recommended because of its sweet, soft-skinned nut, much larger than that of the chinquapin. These hybrids, however, are not immune to canker, which sometimes attacks the trees very seriously. It seems best to grow them in shrubs with several trunks, so that, if one is attacked, it may be cut immediately and its place taken by another.

Mr. VAN FLEET's hybrid chestnut plantation covers an area of about 4 acres. The trees are planted at distances of 6 to 8 feet from each other in rows 12 feet apart.

287 – **Winter Wheats in the United States.** — See No. 257 of this *Review*.

288 – **The Characters and Yields of Australian Wheats.** — See No. 342 of this *Review*.

289 – **Some Effects of the Successive Cropping of Barley.** – GERICKE, W. F., in the *Journal of the American Society of Agronomy*, Vol. IX, No. 7, pp. 325-332. Washington D. C., October, 1917.

The experiments described, carried out in the Laboratory of Soil Chemistry of the University of California, Berkeley, form part of a study undertaken to investigate the effects of successive cropping of barley on soil in pots under greenhouse conditions. All the factors of production, except the soil, were the same or similar throughout the experiment. Five kilograms of soil were put in each pot, some of which were sown and some

TABLE I. — *Yield and ripening, as affected by successive cropping.*

Number of crops in one soil	Number of stalks				Period of harvest	
	total per pot	grain producing	producing heads but no grain	producing no heads	first heads ripe	Last heads ripe
4	5	5	0	0	June 1	June 11
4	6	6	0	0	June 1	June 11
3	20	6	6	8	June 15	July 7
3	12	6	4	2	June 15	July 8
2	21	6	10	5	June 15	July 10
2	23	8	9	6	June 14	July 10
1	29	13	11	5	June 15	July 8
1	40	10	16	14	June 16	July 12

left unsown; so that a series was obtained in which some had produced three crops, some two, some one, and some no crop. Throughout the experiment the culture and water content of the soil was the same for each pot whether it contained growing plants or not. The soil was well supplied with the necessary plant-food constituents and was particularly rich in nitrogen. Analysis by the strong acid digestive method showed it to have the following composition: — insoluble residue, 64.85 %; soluble silica, 9.18 %; Ca O, 2.26 %; Fe_2O_3, 45.9 %; Al_2O_3, 5.80 %; SO_3, 0.4 %; Mn_3O_4, 0.13 %; Mg O, 0.72 %; K_2O, 0.62 %; Na_2O, 0.43 %; P_2O_5, 0.48 %; loss on ignition, 11.94 %; total nitrogen, 0.31 %; humus, 3.20 %; nitrogen in humus, 3.30 %.

The seed used was from a very pure strain of Beldi barley. The appended tables show the results of the experiments.

TABLE II. — *Average height in centimetres of the different classes of stalks as affected by successive cropping.*

Number of crops in one soil	Average height of all stalks	Average height of grain-producing stalks	Average height of stalks producing heads but no grain	Average height of stalks producing no heads
. . . . .	68.6	68.8	—	—
. . . . .	66.6	66.6	—	—
. . . . .	40.7	53.2	29.2	40.1
. . . . .	38.2	42.5	27.5	53.0
. . . . .	35.1	49.7	31.8	24.4
. . . . .	31.6	41.2	29.6	22.7
. . . . .	31.1	38.6	25.8	23.4
. . . . .	28.9	49.0	29.0	20.3

TABLE III. — *Relation of height of stalk to weight of grain as affected by successive cropping.*

Number of crops in one soil	Pot 1				Pot 2			
	Height of stalk	Number of kernels in head	Weight of kernels in head: total	Weight of kernels in head: average of 1 kernel	Height of stalk	Number of kernels in head	Weight of kernels in head: total	Weight of kernels in head: average of 1 kernel
	cm.		gm.	mgm.	cm.		gm.	mgm.
(average of 6 stalks) .	68.6	26.2	1.311	50.0	66.6	20.1	1.387	47.5
(average of 6 stalks) .	53.1	21.6	1.019	47.0	42.5	19.7	0.804	45.4
(average of 8 stalks) . .	49.7	28.7	1.074	37.5	41.2	17.2	0.711	41.2
(average of 13 stalks) . .	38.6	15.0	0.665	41.8	40.9	17.2	0.731	42.5

CONCLUSIONS: 1) Plants of the 4th. crop matured with a greater uniformity than those of any other crops. None of them had barren stalks. The number of tillers and barren stalks increased with the plants grown in soil which had produced a lesser number of crops.

2) The total height of all the stalks produced decreased with each successive crop, but the average height of the individual stalks increased with each successive crop.

3) In the 4th. and 3rd. crops the heaviest grain, both in weight per head and in average weight per kernel, varied with the height of the stalks. The tallest stalks produced the largest ears and highest average weight per kernel.

4) In the 2nd. and 1st. crops there was no correlation between the height of stalks and weight of grain per head or average weight per kernel.

290 - Studies on Maize in the United States: Influence of Position of Grain in the Cob on the Growth of Maize Seedlings. — See No. 271 of this *Review*.

291 - The World's Production of Rice. — See No. 251 of this *Review*.

292 - The Utilisation of the Civet Bean (*Phaseolus lunatus*) Cultivated in Madagascar. — PRUDHOMME, E. and RIGOTARD, L., in *Feuille d'Informations du Ministère de l'Agriculture*, Year XXIII, No. 5, p. 6. Paris, January 29, 1918.

During the last 15 years the cultivation of the civet bean in Madagascar has increased considerably and it is exported in ever-growing quantities; from 17 700 cwt. in 1910 the exportation has risen to nearly 177 000 cwt.; the 1917 harvest is estimated at 196 800 cwt.

The authors discuss the value of the civet bean as a food. It is particularly appreciated in England, where, under the common name of "butter bean", it is eaten like the ordinary dried bean, and is even considered a choice food.

The authors have recently examined many samples of civet beans at the Colonial Garden. The results of the examination of many varieties confirm the statement that large, flat, white seeds, or those with pink spots at the end or near the hilum, about 22 to 24 mm. long, 13 to 15 mm. wide and 6 mm. thick, only contain from 5 to 7 mgm. of hydrocyanic acid per 100 gm. of seed. The average weight of 100 such seeds is between 115 and 189 gm.

Mr. KOLN ABREST, Director of the Laboratory of Toxicology of the Paris Police Service, supplied the authors with data which prove the civet beans grown at Madagascar to be those of all the numerous varieties of *Phaseolus lunatus* which yield the least hydrocyanic acid. They may be eaten without any danger as is shown by the quantities of acid found on analysis: — 100 gm. of beans of this quality contain barely 2 to 3 mgm. of hydrocyanic acid, if the water in which they are soaked and cooked is thrown away. This amount in harmless to adults.

The sale of the beans should be controlled and the hydrocyanic acid content limited to 10 mgm. per 100 gm. of beans. For this it would be sufficient according to the author's studies, to limit the importation to large, flat seeds, the weight of which varies from 1 000 to 15 000 gm. per 1 000 seeds, either entirely white in colour, or slightly mottled with red or pink.

3 - **Winter Potato Growing in the Algerian Sahel.** — BESSON, ANTOINE, in the *Bulletin de la Direction Générale de l'Agriculture, du Commerce et de la Colonisation de la Regence de Tunis*, Year XXI, No. 90, pp. 22-41. Tunis, 1917.

In view of the increasing cultivation of the potato in Algeria for export nd the absolute lack of sufficiently detailed literature on the subject for ie use of the farmer, the author gives information he has been able to colct by his own experiments and numerous observations on the cultivation the early potato.

To obtain good results planting must be early, which, moreover, alws a second crop of tobacco, maize or red potato. The potatoes may be lanted between rows of vines; the cultural methods and fertilisers dispensable to the potato also benefit the vine, and, as the potatoes are fted before the vine shoots appear the care of the latter can proceed ormally.

A detailed study is made of: — 1) choice of land, 2) preparation of the il, 3) live or dead shelter-hedges, 4) choice of seed (the varieties most to recommended are: Grenadine or native potato; Royale Kidney hâtive La Hâtive; Royale Kidney Allemande or Belle de Juillet, harvested in rance; Royale Kidney Allemand or Belle de Juillet, harvested in ermany; Flouque de Jersey; Hainaut or Belle de Fontenay); 5) sproutg of the potato, 6) planting, 7) watering, 8) copper sulphate spraying, 9) ltivation, 10) lifting, 11) sorting, 12) fertilisers.

4 - **A "Water-Potato".** — ROSS, D. M., in *The Journal of Agriculture, New Zealand Department of Agriculture, Industries and Commerce*, Vol. XV, No. 4, pp. 209-210. Wellington, October, 1917.

In the Bay of Plenty district, New Zealand, on the northern bank of he Rangitaiki River, near a fresh water spring, a strong variety of edible otato is found growing amongst watercress (*Nasturtium officinale*). The oots and tubers of the plant are found from 12 to 17 inches below the ater. The potatoes are of fair size and ripen as early as August; when ooked they are waxy.

The author sent some of the tubers to the Moumahaki Experimental arm to see if they could be grown on dry land. Planted on August 31, 916, they gave vigorous plants with distinct foliage and large blue flowers hich bore seed-apples. The crop was lifted on February 6, 1917, and was ee from disease. The yield was 12.87 tons per acre, 11 tons of which are arketable (table and seed) and 1.87 tons were pig-potatoes. Boiling tests howed that the potatoes kept their colour well but could not be classed s good cookers. The starch content appears to be high.

195 - **Three Fodder Pulses of Bihar and Orissa: Meth, Bhringi and Mashyem Kalai.** — GOSH, A. C., in *Department of Agriculture, Bihar and Orissa, An Agricultural Journal*, Vol. V, No. 1, pp. 15-17, 14 tables, 5 plates. Patna, 1917.

A systematic study has been made of the pulse crops grown in the botanical experimental area at Sabour (Bihar and Orissa, India). A botanical escription and detailed observations are given of the different varieties, atural crosses, soil, sowing, cultivation, uses, etc.

Some of the most important data on Meth (*Phaseolus Ricciardian* Ten.), Bhringi (*Phaseolus aconitifolius* Jacq.) and Mashyem Kalai (*Phas lus calcaratus* Roxb.) are given in the following table.

	Phaseolus Ricciardianus(1)	*Phaseolus aconitifolius*(2)	*Phaseolu calcarat*
Length of main stem	1-2 ft.	1-3 ft.	16-27 inch
Yield per acre: green fodder (average of 3 tests)	10323 lbs.	3 700 lbs.	10 057 lbs
Yield per acre: grain	523 lbs	—	532 lbs.
Composition of green fodder:			
Water	62.73 %	50 %	70 29 %
Albuminoids	5.02	6.94	3 97
Amides	1.53	1.13	0.93
Crude fibre	3.18	4 25	3.42
Ash	5.11	8 91	3.42
Silica in ash	1.65	4 88	0.93
Digestible carbohydrates	22.43	28.77	17 47
Composition of unhusked seed:			
Moisture	8.10 %	8 65 %	9.83 %
Ether extract	0.50	0.68	0.38
Albuminoids	21.52	22.38	20.42
Nitrogen in albuminoids	3.40	3.58	3.2
Crude fibre	6.38	3 88	4.33
Digestible carbohydrates	59.62	60.59	60.61
Ash	3.87	3.83	4.33
Silica in ash	0.07	0 07–0.1	0 002–0.

(1) Yellow seed variety. (2) Black mottled seed variety.

USES. — *Ph. Ricciardianus.* — Chiefly grown for green fodder. T seeds, though indigestible, are used as human food; entire or partly crush seeds steeped in water overnight are given to cattle and horses. The str and husks are used as a food for cattle.

Ph. aconitifolius. — The seed is used for human consumption. T pod husks and straw are fed to cattle.

Ph. calcaratus. — Grown particularly for green fodder. The seed, first baked and crushed, may be used for human consumption.

296 – **Grass Experiments at Hawkesbury Agricultural College, 1916-17.** — KERLE, D., in *The Agricultural Gazette of New South Wales*, Vol. XXVIII, Pt. 2, pp. 895 Sydney, November, 1917.

The year ending June 30, 1917, was exceptionally dry. The rainf was 29.610 inches, nearly half of which fell during the three months Octob December.

The experiments were divided into two series: 1) rows of 116 li in length and 2 ½ feet apart, 2) field plots of 1/7 acre.

The first trials, besides their use for study and instruction, had as a *a*) to determine the suitability to the district of the common native and int

luced grasses; *b*) to determine the value of newly-introduced grasses;) to improve varieties by selection.

The second trials aimed at: — *a*) testing under ordinary field conditions hose varieties which had given good results in the row trials; *b*) to establish eed reserve areas, the seed of the best plants being distributed to the farmers or testing. The soil was a light volcanic loam of comparatively uniform composition.

ROW TRIALS. — Three new grasses were tested: *Pennisetum massaicum*, *P. tristachya*, and *Setaria nigrirostris* (South African Pigeon Grass). The first proved worthy of further trials. It stooled well, resisted several severe frosts in early winter, grew to a height of 2 ½ feet, but was eventually destroyed by a succession of very heavy frosts. The second, a native of Brazil, did badly. The third stooled well, grew strongly in autumn and reached a height of 5 ½ feet; it, however, gives a coarse fodder and is killed by frost.

Field trials. — As the row trials, these were started in 1913.

In 1913 were grown: —

Eragrostis curvula, var. *valida* (a Love grass) — *Andropogon intermedius* (Rare blue grass) — *Eragrostis leptostachya* (Paddock Love grass) — *Paspalum dilatatum* — *Chloris Gayana* (Rhodes grass) — *Anthistiria avenacea* (Tall Oat grass) — *Bromus inermis* (Awnless Brome grass) — *B. unioloides* (Prairie grass) — to which were added: in 1914; *Pollinia fulva* (Brown Top grass or Sugar grass); in 1915; three new strains of *Bromus inermis* — *Phalaris bulbosa* (Toowoombe Canary grass); in 1916: *Schedonorus Hookerianus* (Hookers Fescue) — *Festuca arundinacea* (Giant Fescue) — *Pennisetum purpureum* (Elephant grass or Napier's Fodder grass) — *Andropogon Sorghum* var. (Sudan grass); in 1917: *Deyeuxia coarctata*.

Eragrostis curvula. — Gives a coarse fodder unsuited to cattle in New South Wales; discarded.

Andropogon intermedius. — Growth good; height 3 ½ feet; yield 3 ons 18 cwt. per acre; gives the highest yield of succulent forage of any f the New South Wales native grasses. Its chief merits are: — drought esistance, succulence, palatableness to stock, free seeding.

Eragrostis leptostachya. — A native grass; reaches a height of 2 ft.; ery hardy; seeds freely; bears heavy stocking, average yield, 2½ tons er acre.

Paspalum dilatatum. — Considering the wetness of the beginning of he season, this plant grew and produced excellently (height 5 ft., yield tons, 2 cwt. 3 qrs. per acre); in dry seasons it hardly grows at all, and herefore, can not be recommended.

Chloris Gayana. — Average height 4 ft., yield of forage 5 tons 5 cwt. qrs. per acre; growth fair in both dry and wet seasons, but not readily aten by stock because of its sour taste,

Anthistiria avenacea. — Native; drought resistant; height 5 ft. 3 in.; ield of greenstuff 5 tons 1 cwt. per acre; not to be recommended on ac- ount of its coarseness and poor seeding capacities.

Bromus inermis. — Height 2 ½ ft.; yield of grass 3 tons 5 cwt. per cre; is not well adapted to the coast, but does well in the northern and cen- ral Tablelands, and in the irrigation area.

Bromus unioloides. — The plot sown in 1913 has always given excellent harvests; the variety, normally annual, has there become perennial. Merits: — resistance to frost, free seeding habit, palatableness. Chief defect: — inability to withstand heavy grazing.

Pollinia fulva. — Native; height 3 ft. (rare); yield of greenstuff 4 tons 2 cwt. per acre; tender, relished by stock.

Phalaris bulbosa. — Height 5 ½ feet; yield 7 ½ tons per acre; fodder tender, easy to harvest and thresh; excellent hay; grain has high percentage of germination; resistant to cold, but only slightly so to hot, dry summers; the best winter and spring grass tested at Hawkesbury.

Schedonorus Hookerianus. — Native; drought and frost resistant; adapted to high districts; grows little, fodder coarse.

Festuca arundinacea. — Grows little; fodder coarse.

Deyeuscia coarctata. — Promising; fodder tender.

Pennisetum purpureum. — Great growth and very high yield, height 10 to 11 feet with 60 to 80 stalks per stool, 21 tons per acre; does not set seed, but is easily propagated by cuttings or roots; dairy cows eat the whole plant when it is chaffed, but otherwise only the leaves.

Andropogon sorghum. — It gave two harvests during the year, yielding a total of 6 tons 10 cwt. 0 qr. 15 lb.; a plot grown for seed threshed at the rate of 623 ½ lb. per acre. It gives a higher yield than Hungarian millet (*Setaria italica*); resists summer drought; grows rapidly; is specially suited for a hay or soiling crop. Of all the grasses tested at Hawkesbury this is the best adapted to dry climates, and, under normal conditions, is superior to the others as a hay or soiling crop.

297 – ***Wrightia annamensis*, a Textile Fibre Plant of Indochina.** – See No. 348 of this *Review*.

298 – **Strawberry Growing in the United States.** — DARROW, GEORGE, M. — I. Strawberry Culture in Tennessee, Kentucky and West Virginia. *U. S. Department of Agriculture, Farmer's Bulletin* 854, pp. 24, 11 figs., bibliography. Washington, August, 1917. — II. Everbearing Strawberries. *Ibid.* No. 901, pp. 19, 7 figs. Washington, November, 1917.

I. — Strawberries are very largely grown, both intensively and extensively, in Tennessee, Kentucky and West Virginia. Intensive methods are the best suited to the district. The author deals with the following points: — choice of farm; choice of field; preparation of soil; fertilisers (acid phosphate and steamed bone meal are most commonly used, being applied at the rate of 200 to 800 lbs. per acre; stable manure should only be applied to crops preceding strawberries); planting (at intervals of about 3 ft. in rows 3 ½ ft. apart; the distance between the plants should be reduced to 18 inches if there is any danger of the plants' being killed by insect larvae or drought); after hoeing, the ground is usually covered with straw while the plant is growing); methods of cultivation.

The Klondike variety is that most extensively grown in Tennessee. The Aroma is found especially in the north of this State; round Nashville, Gandy is preferred. In Kentucky, Aroma is considered the best variety, but in heavy clay soils Gandy is considered best. In other parts of Ken-

ky and in West Virginia the chief varieties grown are Gandy, Aroma
l Dunlap.

II. — Most of the European everbearing strawberries are descended
hybridisation from the Alpine strawberry. The American everbear-
strawberries, however, are derived from a plant bearing flowers and fruit
all the stages of its development, found by Mr. SAMUEL COOPER in 1898
ong plants of the Bismarck variety, considered to be a cross between the
n Deman and the Bubach varieties. Mr. COOPER named this plant Pan
erican, and from it he obtained other varieties bearing fruit till autumn ;
ongst these may be mentioned: — Autumn, Productive, Superb (the widest
own and the best), Peerless, Onward, Forward and Advance. The value
the last four has not yet been determined, but Peerless seems to have
racters superior to those of Superb.

Mr. HARLOW ROCKHILL of Iowa has obtained many everbearing plants
crossing the European variety, Louis Gautier, with the Pan American
l other varieties which normally only bear fruit in early summer. The
t known of the varieties thus obtained is Progressive (Dunlap × Pan
erican) ; mention may also be made of the varieties Iowa and Standpat
th derived from Pan American × Dunlap). Other varieties, the value
which has not yet been determined, have been obtained by different
rkers, especially at the Minnesota Agricultural Experiment Station.

The characters and adaptation to different parts of the United States
first examined, and the following points then discussed: — soil ; time
l method of planting; cultural methods; harvesting; yields. East of
Rocky Mountains the Superb variety is less productive than the Pro-
ssive, but, under favourable conditions, over 1000 quarts per acre may
obtained in summer and autumn. In the irrigated districts of Idaho,
gon and Washington, where the conditions seem more favourable to
s variety, the yields are higher. The early summer crop of Superb is
erally larger, with bigger berries, than that of Progressive. The va-
ties of everbearing strawberries now on the market are: — Advance, Ameri-
, Autumn, Forward, Francis, Iowa, Onward, Pan American, Peerless,
ductive, Progressive, Standpat and Superb. The Superb and Progres-
e varieties are most widely grown. Another variety, obtained in 1910
Minnesota No. 1017 — distributed by the Minnesota State Horticultural
iety, has been introduced on to the market. It is very vigorous and very
ductive, with globular, dark red, firm berries of excellent quality. Al-
ugh grown in Minnesota and the neighbouring States, this variety is
to be recommended at present for general planting because, in certain
tricts, it has been found to show but slight resistance to cryptogamic di-
ses.

— **Raspberry Culture.** — DARROW, GEORGE M., in the *U. S. Department of Agriculture, Farmer's Bulletin* 887, pp. 44, 33 figs. bibliography. Washington, October, 1917.

In the United States the raspberry is grown, not only in small plantations for the home and local market, but, in some districts, as the principal commercial crop. Statistics show that, in 1909, there were 48 668 acres raspberries in the United States.

The methods of cultivation on estates which specialise in raspberries a very progressive. Detailed information is given on : — choice of plantatio preparation of the land ; planting (there are 3 methods of planting — 1) t hill system, in which a horse cultivator is used on all sides of the plan 2) linear ; 3) hedges, where the cultivator is used in one direction only manuring (an average of 10 tons per acre of stable manure, leguminc cover crops to be dug in as green manure) ; training and pruning ; win protection.

The yields vary greatly according to the variety grown, the meth used, and climatic conditions. In New York the average yield is from 1 to 1400 quarts of red raspberries per acre. In Colorado, the Marlbo variety, if well protected during winter, will yield over 4 000 quarts per ac In the Puyallup Valley (Washington), fields of Cuthberts properly cared will yield 6 000 quarts per acre, and the Antwerp, 8 000 quarts per ac

The best varieties now grown are : —

RED AND YELLOW VARIETIES : Antwerp, Cuthbert, Eaton (including the varieties Ha and Iowa), Empire, Golden Queen, Herbert, June, King, London, Marlboro', Miller, Ot Perfection, Ranere (St. Regis variety), Ruby, Sunbeam, Superlative, Surprise, Welch.

PURPLE VARIETIES : Cardinal, Columbian, Haymaker, Royal (Royal Purple vari Shaffer.

BLACK VARIETIES : Cumberland, Farmer (Plum Farmer variety), Gregg, Hoosier, Kan Ohio, Older, Pearl (Black Pearl).

A large part of the raspberry crop is marketed in the fresh stat The Census Bureau estimated the value of canned raspberries in 1914 to $1 137 207.

300 - **Citrus Cultivation in Surinam.** — LIEMS, J. A., in *Department van den Landbo Suriname, Bulletin* No. 35, pp. 29 + plates. Paramaribo, November, 1917.

There are many orange trees scattered about the plantations in Dut Guiana, but orange groves have only been formed there more or less cently ; the first, planted at Vredenburg, contained 142 trees. Near Sur nam is a nine year old grove covering about 4 ½ acres, and another cov ing nearly 34 acres, composed of native citrus trees from 3 to 8 yea old. Other groves have been planted near the Commewyne Rive In order to increase the cultivation of citrus trees the Department of Ag culture of the Colony has recently distributed, amongst small holders, large quantity of grafted orange trees. Of all tropical fruits the oran is the best adapted to export. Exportation was begun in 1907 and, sin then, the local Department of Agriculture has shipped oranges and tange rines to Holland. From the point of view of the prices obtained the resu were encouraging. In 1909, 0.24 *d.* was obtained per orange sold in Ho land ; in 1910, ½ *d.*, in 1914, 0.36 *d.* In 1911, as a result of delay in t departure and voyage of the boat carrying them, the oranges arrived in unsaleable condition. In 1912, as the crop was poor, no fruit was exporte The experiment was a complete failure in 1913 as a result of the unfavo able shipping conditions. As the boats were not suitably fitted for carryi oranges, a large number of damaged fruit was found in all the shipments t Holland. According to the author, there is no doubt that, when normal co

ions prevail again, the shipments may be re-started under conditions ourable to the keeping of the oranges during transport, so that a better ce will be obtained for the fruit exported. In Surinam the oranges ri- from July to October, the months during which they are absent from European market. As Surinam oranges are larger and of better fla- r than European ones, they are much in demand on the Amsterdam and tch inland markets.

The rules to be observed in sowing seed, care of the seedlings in the sery, grafting, final plantation (in squares, 25 feet apart, or about 70 s per acre), cultural methods, etc. are given.

The chief disease is gummosis, found in groves where the trees are too e together. The chief injurious insects are ants, which greatly damage orange trees, and scale insects, which attack particularly young nursery nts.

As the cultivation of orange trees is relatively recent in Surinam, it oo early to state which foreign varieties are to be recommended. Lambs mmer variety produces, in sandy soil, good fruit much appreciated in tope, but which ripens a little late. The Washington Navel orange is good and less juicy than the native fruit. The Director of the Botani- Garden and the author have sought the best varieties for propaga- among the native varieties.

A yield of 1000 fruit per adult tree is not exceptional. At Vreden- in 1911, a tree gave 3 800 fruit. The average yield per tree may be ed at 500 fruit. Estimating the sale price at ¼ *d.* per orange, an acre 5 trees with an average of 500 fruit would bring in about £ 40 ; from must be subtracted the cost of cultivation, placed at about £ 4.

The methods of packing are described, those used in California for ping oranges being specially recommended.

- **The Nigerian Lime Tree (*Citrus medica* var *acida*).** — See No. 254 of this *Review*.

- **The Cultivation of the Pistachio Tree.** — See No. 254 of this *Review*.

VINE GROWING.

- **Hybrid Bearers in 1917 in France.** — L'ÉE-LABY, E., in *La Vie agricole et rurale*, Year VII, No. 32, pp. 103-106 ; No. 36, pp. 170-173. Paris, 1917.

In view of the ever increasing damage caused by cryptogamic diseases the vineyards, the use of hybrid bearers becomes essential, and it is isable to plant them without hesitation. The principal hybrids, new old, are described with special reference to their behaviour in 1917, cially in the author's experiment plot at Toulouse.

I. — BEHAVIOUR OF SOME OLD HYBRIDS. — *Seibel* Nos. 1020, 156, 128, 7. The attack of black rot which occurred during the first days of June no serious effect on these four hybrids. There were a few patches on the es, and very little on the pedicel of the bunch. None of them spread on unt of the prolonged drought and heat. Some French plants, such as *ugais bleu* and *Grand noir* suffered rather badly in Bas-Languedoc ; in agnac some districts were seriously affected by this disease. Only in

some badly exposed rows were blisters causing loss of grapes on the bunch of 1020, 128 and 156. These three hybrids gave excellent crops.

Mention must be made of 128 on account of its remarkable behavio in 1917, with goodsized fruit. The plants, which had been attacked black rust two years before, and had given no harvest since then, gave particularly heavy crop without any treatment whatever. The two stoc which suit it best are 3306 and Rupestris du Lot. In the experiment pl at Toulouse it does as well direct as grafted.

As usual 1020 yielded well, perhaps better ungrafted than grafte Except a few badly exposed plants which suffered from mildew and oidiu they were all healthy with yields which varied according to the sto In 1917, the stocks which appeared to suit it best were 34-E and 33

There is nothing of particular interest to be noted for 1077, wh behaved as usual. It must be noted that this hybrid, known to be sensiti to black rot, showed no patches on the clusters as the others did. This probably because it was grown in a more airy, sunny place with a better e posure.

These four hybrids have never been treated with sulphate or sulph during the ten years since they have been planted. There is no doubt tha had they been treated with copper or sulphur, they would not ha suffered from the attacks mentioned, or only to a very slight extent.

Seibel 138: — An excellent plant, either direct or grafted. The lace-li patches of mildew on its leaves never attack the grapes and do not preve them from ripening; if it does not yield heavily it at least yields regular

Seibel 1003: — has never failed to give a crop of medium sized grape it suffers more from lime than from mildew.

Seibel 2: — always gives a regular and good yield; suffers very litt from mildew; does well with Riparia as stock.

Seibel 1000: — did very well as in the preceding years, but lost part its fruit as a result of black rust; the harvest was reduced by half; neith the soil nor the climate of the Toulouse Garden suit it; but it does very w elsewhere, especially in the south.

Seibel 1070: — does very well in good exposures; always has a hea crop; suffers from oidium, but one or two good sulphurings protect it.

Couderc 7103: — has the same fault and needs the same treatmen gives a fairly good yield; not too sensitive to mildew.

Couderc 7104: — showed its usual good and bad qualities; lacks v gour when ungrafted and with most stock; it gives a small harvest b excellent grapes.

Couderc 7120: — always the same, suffers from no disease and gives average, but regular, harvest; produces better in the south than in th south-west.

Couderc 4401: — its principal fault is that its suffers from oidium a black rust; in the author's garden, part of the crop is lost each year as a sult of this last disease; elsewhere, if well tended, it produces well and wit out non-setting.

Girerd 157: — *white*, is placed among the old hybrids because, in spi

of its faults, it is found everywhere at the present time; it is fairly liable to mildew and not resistant to oïdium; in 1917, as in preceding years, the leaves which had not been sprayed with sulphate were attacked, but there was neither grey rot nor red rot on the clusters; it is in demand everywhere because if treated with sulphate and sulphur its heavy yield (about 9 to 13 lbs.) is assured.

It is seen that among these old hybrids are some good ones, which, in the absence of others, might be used, for 128, if well exposed, 156, and Nos. 2, 138, 2003, 1070 and 7120 always give relatively good yields, especially if treated once or twice with copper and sulphur. *Girerd* and 1020 are now appreciated everywhere. There are, however, more recent hybrids which are justly considered superior to the preceding ones by reason of better grapes, a greater resistance, and absence of certain faults, recognised by those who grow them or make wine with them.

II. MORE RECENT HYBRIDS. — A. BLACK HYBRIDS. — (Untreated with copper and sulphur)

Seibel 753: — has just a few small unimportant spots of mildew on its leaves, the grapes are intact, of good size, well-spaced; very regular.

Seibel 873: — resists mildew well, did not suffer in 1917 either on the leaves or fruit, which is large, close and almost average.

Seibel 4121: — remarkable for the resistance of its leaves and its clusters; the author has never seen the slightest sign of disease on it; bears a good crop, and, although its fruit is not very large it gives 13 lbs. or more per plant; neutral wine, strongly coloured, giving, in 1916, 9.6°; strong plant, doing as well ungrafted as grafted; bushy.

Seibel 4643: — only has a few negligible spots of mildew on its leaves; grapes intact, fairly long, not very close, excellent, sweet, giving a first class wine; rather similar to French plants.

Gaillard 194: — completely immune to mildew in the Toulouse Garden; elsewhere it is said to suffer slightly from this disease; in the Toulouse garden it is more vigorous direct than grafted, and to such an extent that the grapes did not all set; must be carefully pruned to avoid loss of the many grapes; ripens early; wine much appreciated.

Jurie 580: — has the appearance of a stock plant with hardy leaves; rarely subject to mildew; gives a heavy yield in good soils; very strong, does as well grafted as ungrafted.

Malègue 829-6 and 1551-2; liable to black rust which excludes them from certain damp districts; it may be protected from mildew by one or two sulphate sprayings; the second is rather later than the first; very good wine.

In this group of black grapes, *Seibel* 4 121 and *Jurie* 580, are noted as particularly hardy; the two *Malègue* mentioned, as finer and almost equally good yielders.

B. PINK HYBRID: — *Seibel* 2859 *rose*; resistant to mildew without sulphate spraying; good yielder; good wine.

C. WHITE HYBRIDS. — This group includes plants valuable both for their resistance to disease and their produce.

Seibel 793: — highly recommended on account of its great resistance

to all diseases ; if the grapes and seed are not very large, there is at least the certainty of an annual harvest, without non-setting, of good flavour, without the expense of copper or sulphur.

Seibel 850 : — less resistant than the preceding one, but can do without sulphate treatment in years such as 1917; resisted well in the author's experiment plot ; fruitful ; average clusters with average grapes.

Seibel 880 : — can, if necessary, do without sulphate spraying ; good and regular yielder, giving excellent grapes, but often below the average; appears to be derived from 2 red parents — 28-112 and 2003.

Seibel 867 : — fine, cylindrical cluster, winged, fruit above the average, does not suffer from non-setting or other defects ; may be said to be immune to all diseases ; wine said to be slightly foxy, which is not surprising as the plant is descended from 2003 and *Noah*, but is much less foxy than wine from *Noah*.

Seibel 2653 : — valuable as a table grape in the absence of *Chasselas*, so long as it does not abort too much ; its chief fault in some years is liability to non-setting in certain districts; not so subject to mildew as *Chasselas* and is satisfactorily protected against strong attacks by two or three sulphate sprayings ; fruit big, oval, and excellent, not subject to oïdium.

Seibel 4773 : — like 793 it is immune to all diseases, but gives a higher yield; its wood and veins are also red, especially when growth begins, longer fruit rather wider apart ; very sweet juice.

Seibel 3021 : — very slightly subject to mildew ; without ever having been treated with sulphate it lost no leaf through this disease; grapes only average, or below the average, close-set and of good flavour, ripen in the second late period.

Seibel 4681 : — has still better foliage ; cannot do without copper and sulphur; yield below the average because fruit is below the average ; wine of good flavour and alcoholic.

With the exception of No. 2653, which requires two or three sulphate sprayings, all the other white hybrids can do without sulphate. If they do not give a high yield of 22 lbs. per plant they give a regular average yield of good-flavoured grapes, except 867 which is slightly foxy, and a wine rich in alcohol which may be used either alone or mixed, and is of great value for blending wines.

Couderc 235-120 and 272-60 ; the first yields well and is easily protected ; the second is subject to oïdium.

Malègue 1157-1 and 1897-12 ; do well in the Toulouse district with an average of two sulphate sprayings ; a fairly large quantity of grapes above the average, ripening in the second late period, excellent wine ; the first is slightly subject to mildew.

III. NEW HYBRIDS. — These hybrids have been grown *directly* in the experiment garden since 1914 ; they are at their third leaf. They have also been grafted on various stock, and put in next to the direct plants the following year. None have been treated with copper or sulphur ; the square on which they are grown is about 9 yards from a *Chasselas* vine which was sprayed four times and eaten up by mildew. Round the edge of the plot

are hybrids which lost almost their whole harvest through mildew, black rot and oidium. Although the hybrids of this collection are not entirely immune to disease, they suffer less than the older ones. Their relative resistance may be seen at a glance and an ascending or descending scale easily constructed. For the vine-grower their value lies in the comparisons which may be made between the relative quality of about 60 hybrids grown side by side under identical cultural conditions and without any treatment.

The most important are :

A. WHITE HYBRIDS : — *Seibel* 4657, direct ; large leaf, wide, with shallow lateral sinuses ; large widely-spaced, very pointed teeth at edges, more marked than those of the muscatel, dark green, dull ; internodes from 13 to 15 cm., green, not red ; bunches large, branchy, loose, with oval fruit above the average, fairly far apart, ripening at the end of the first period, of good flavour and very sweet ; may be regarded as a table and vat grape ; very fruitful ; does not appear to be subject to non-setting, and is, consequently, a good yielder ; with neither sulphur nor sulphate treatment it only had a few insignificant spots of mildew on some of its leaves.

Seibel 4986 : — direct ; very vigorous ; leaves with deep sinuses and rounded at the base, very large, very pointed shiny teeth, set far apart ; long internodes of 17 to 20 cm ; bunches, mostly winged, cylindrical-conical, with round, fairly close fruit, average or above the average, ripening at the end of the first period ; good flavour ; very productive, does not non-set, thus giving a good yield ; very resistant to mildew and oïdium.

Seibel 4633 : — direct ; best yielder of the whole collection ; excellent leaf of an almost dark green, shining as if varnished ; lateral sinuses absent, those preceding the tip, fairly marked, giving the leaf a round appearance ; teeth fairly wide and regular, internodes 9 to 10 cm. long, of green, thick wood ; very fruitful ; bunches above the average with round fruit, above the average, close, ripening in the second period, good flavour, almost perfect resistance, subject to neither mildew, oidium, nor black rust.

Seibel 4603 : — direct ; the lower leaves are dark green and cut out like those of a fig tree, the sinuses being shallow but the teeth round them well marked ; internodes 9 to 10 cm. long of green wood ; clusters cylindrical or fairly conical, with round, average, close fruit of good flavour ; very resistant to mildew.

Seibel 4955 : — direct ; leaves have hardly any sinuses and appear round, of the green of Rupestris and of average size ; internodes relatively short of 7 to 8 cm ; wood green ; very fruitful ; bunches cylindrical, usually above the average, with fairly close, round, average fruit ; a very few patches of mildew on the leaves.

Seibel 5279 : — direct ; leaf appears round and is only pointed at the base, where there are two shallow sinuses ; teeth few but fairly pointed ; tissue, lightly leathery as that of the Noah leaf ; internodes from 6 to 9 cm. ; wood green ; very fruitful ; clusters average, rather long, wide at the base, above the average ; fruit close, round, average, ripens early, end of August, grape sweet, excellent, remains a long time on the bunch and is a good keeping grape ; strong resistance to oïdium and mildew.

Seibel 4709 : — direct ; leaves long with normal sinuses, slightly pointed teeth, of a dark green colour ; internodes fairly large, from 8 to 10 cm., wood green; very productive, clusters average, not very long, squat; grapes average or above the average, round, close, of excellent flavour ; ripening during the first period ; very resistant to disease, barely a few spots of mildew in autumn.

B. RED HYBRIDS. — *Seibel* 4015 : — direct ; leaves large and heart-shaped, without pronounced lower sinuses, teeth fairly prominent ; wood of shoots green ; internodes from 12 to 14 cm.; very fruitful and, on account of its average clusters with average, round fruit, very productive; ripens during the second period ; foxy flavour, which is its only fault; remarkable resistance to disease.

Seibel 4565 : — direct ; leaf large, wider then it is high, round, no sinus, large teeth ; seems fairly hardy ; wood green ; internodes average from 8 to 9 cm.; very fruitful and productive ; cluster conical, long, above average; fruit average, fairly close, round, ripening during the first period, slightly pulpy ; fairly good resistance to disease.

Seibel 5145 : — direct, average leaf, round, with appearance and red veins of the Berlandieri leaf, without well-marked teeth ; wood red ; internodes fairly long, 10 to 12 cm.; good producer ; clusters above the average, long and sometimes winged, fruit average, round, juicy, ripening during the second period ; excellent resistance to disease.

LIVE STOCK AND BREEDING.

304 - **Screw-Worms and other Maggots Affecting Animals.** — BISHOP, F. C., MITCHELL J. D. and PARMAN, D. C., in *U. S. Department of Agriculture, Farmers' Bulletin* 857, pp. 8 figs. Washington, September, 1917.

The screw-worm (*Chrysomyia macellaria* Fabricius) is a native of America, and is found from the extreme south to Canada, but is rarely abundant in the Northern States, as the fly is quickly killed in cold weather. The states of North America which suffer most severely are Texas, Oklahoma, New Mexico, Arizona and Southern California.

Practically all animals are attacked by this insect. Probably cattle suffer most ; hogs, horses, mules, sheep, goats and dogs follow in the order named. Wild deer (*Cariacus* sp.) and many of the smaller mammals are sometimes seriously infested. Human beings are also frequently attacked. The female lays its eggs in wounds or skin injuries, where the parasite remains throughout the larval stage. The pupa is usually found in the ground. A huge number of eggs may be deposited in a mass by a number of females. In livestock the parasite always causes loss of appetite and emaciation, and sometimes death. In some districts it makes calf-rearing almost impossible (the fly lays its eggs in the navel of the new-born calf often causing its death) and older cattle have to be bought elsewhere. In sheep it causes emaciation and decreased milk production, and in all cases involves increased expenses for the watching and treatment of animals

The screw-worm fly is the only species in the south-west of the United ates which penetrates the sound tissues of animals, but other flies attack e diseased tissues of wounds and soiled wool. These flies are: — the black owfly (*Phormia regina* Meigen), green bottle fly (*Lucilia sericata* Meigen), d gray flesh flies (*Sarcophaga texana* Aldrich, *S. tuberosa* var. *sarracenioides* ldrich, *S. robusta* Aldrich). All these flies breed in decaying animal mat- r, especially in carcasses of large animals. If all dead animals were operly disposed of no cases of infection of living animals would occur.

The best method of control is the burning of carcasses. This reduces e danger of infection by anthrax, tuberculosis and similar diseases in the stures and prevents the breeding of flies in the carcasses. If it is not pos- ble to burn the carcasses they should be buried, covered with quicklime specially if the death of the animal may be attributed to an infectious sease) and then covered with at least 2 feet of soil.

Methods of controlling the parasite in cattle are: — avoidance of injury, lving at a time when the flies are not abundant (between December 1 and e middle of April, and, in the north, from November 1 to June 1), destruc- on of ticks, performance of surgical operations (castration, dehorning, c.) in winter or the beginning of spring, poisoning and trapping the flies. o prevent the larvae from infesting the wool of sheep, lamb early and dip d clip soiled sheep. To avoid dehorning, hornless types may be bred. he animals must be continually watched so as to discover the first symptoms infection, and the larvae killed with chloroform, the wounds being then eated with pine tar to repel the flies.

Appended is a list of 33 publications issued by the United States De- rtment of Agriculture on insects affecting the health of man and domestic imals.

5 - **The Cause and Prevention of Hairless Pigs, in the United States.** — WELCH, HOWARD, in *Montana Agricultural College Experiment Station, Circular* 71, pp. 37-47, 9 fig. Bozeman, Montana, 1917.

It has been known for some years that, in certain of the Northwestern tes, the new-born of all the domestic animals were in some way defective. w-born pigs were hairless and seldom lived; the calves were often hairless d more frequently had goitre. The young of sheep and goats were simi- ly affected, while new-born foals, though neither hairless nor having goi- , were weak, seldom able to stand and usually died.

In Montana, the loss is probably heaviest in young pigs, for about 000 are estimated as dying from this cause annually. In some localities gs are the only domestic animals affected, while in others, it may be lambs ly. It is a disease of definite localities, occurring in Montana in the drain- e basis of the Yellowstone, the lower Missouri, the Musselshell and some the smaller tributaries; outside this zone, a number of scattered cases nstitute about 5 % of the total loss. In some cases, the pig crop can be ved on moving the pregnant sows a mile or two out of the affected district ring gestation. The malady varies curiously: one year it may cause % loss, and nothing the year after. There are also variations in a sin-

gle pen of pregnant sows. Pigs born in March and April are more often affected than those born in May and June, while autumn-born pigs are frequently normal even in badly affected districts.

Amongst causes of the trouble have been suggested : — contagious abortion ; alkali in the soil ; some particular feed, such as alfalfa, flax, maize, or wheat ; or some deficiency in the soil or water. All these causes have been studied by the author, but negative results were always obtained.

Post-mortem examinations showed : — that the hairless pig has a thick, pulpy skin, especially round the head, neck and shoulders ; that the thyroid gland was very hypertrophied and the heart not fully developed. The development of goitre and the hairless condition are of related gravity. This led the author to suppose that goitre was the cause of the disease, and he found by analogy with human goitre, that the hypertrophied thyroid glands contained much less iodine than the normal quantity, or even none. He therefore concluded that the cause of the malady is lack of iodine in the food and water given to the animals, and that it was worth testing whether this insufficiency could be compensated for by giving potassium iodide. Tests made with pigs (with 129.5 to 324 mgm. of potassium iodide per head per day) with female breeding stock during gestation, gave positive results. Iodide of potassium given to a pregnant female prevents goitre appearing in the newborn. Therefore, it is advisable to feed iodine to pregnant animals in regions where goitre is prevalent.

3 6 - **Iron as an Antidote to Cottonseed Meal Injury** (1). — WITHERS, W. A. and CARRICO, FRANK, F., in *The Journal of Biological Chemistry*, Vol. XXXII, No. 2, pp. [illegible], 4 diagrams. Baltimore, November, 1917.

Experiments carried out at the Chemical Division of the North Carolina Agricultural Experiment Station, West Raleigh, showed that, though rabbits are very sensitive to poisoning by cottonseed meal (obtained by extraction of the oil by solvents) even when it has been cooked a long time, they could be successfully fed with this meal for a long period (the experiment lasted 106 days) if it were mixed with ferric ammonium citrate. The authors extended these experiments, using pigs as subjects, in order to investigate whether the harmful action of cotton seed meal is due to an injurious substance or, as some assert, to inadequate or badly proportioned diet.

Although the addition of iron salts is not to be recommended as a practical method for overcoming cottonseed meal poisoning, the experiments show that, when such salts are present, much larger quantities of the meal may be fed, with a resulting increase in body weight ; in some cases it was even possible to prevent death, in many, to retard it. Further evidence of the presence of a toxic substance in the meal is the fact that extraction with alcoholic alkali removes the toxicity (experiments with rabbits). The authors assume the loss of toxicity to be due to : — 1) the formation of an insoluble iron salt of gossypol or one of its derivatives ; 2) the catalytic

(1) See also F. January, 1918, No. 64. (*Ed.*)

celeration of the oxidation of gossypol; 3) perhaps a tonic action iron.

When cottonseed meal is treated with iron salts it turns brownish ack, proving that a reaction takes place with some component of the meal. ne action of iron salts on a solution of gossypol produces a similar colour. ne fact that the effects of the toxic factor may be inhibited by the action iron salts shows that the toxicity of cottonseed meal is not due to a lack "vitamines" or to a deficiency in calcium, sodium and chlorine, as might expected from the chemical analysis of a diet of maize and cottonseed eal.

It is interesting to note that, in the authors' experiments, wood ashes id no antidotal action in preventing the death of pigs fed on maize and cotnseed meal, but the animal receiving ashes made much better gains, obably because of the improvement in the inorganic part of the diet. he appended table gives the results of one of the four experiments. In each the four experimental groups were 9 pigs fed with a mixture of 25 % cotnseed meal, and 75 % maize meal. To each 4 lbs. of feed the control group which no iron salts were given) received 1 gallon of water, group 2, 1 galn of copperas solution (1 lb. $FeSO_4 7H_2O$ dissolved in 50 gallons of water), oup 3, 1 gallon of ferric chloride, containing approximately the same nount of iron as the preceding solution; group 4, 1 gallon of water with rdwood ashes *ad lib.* The experiment lasted 94 days.

Effect of the addition of iron to a diet composed of 25 % *cottonseed meal and* 75 % *maize meal.*

roup	Feed	Weight (in lbs.) Initial	Final	Daily gain	Cottonseed meal eaten	Deaths (among 9 animals)
1	Control	103.4	107	0.05	47	6
2	Copperas	92.1	134.6	0.46	66	3
3	Ferric chloride	102.2	163.2	0.68	8[illegible]	1
4	Hardwood ashes	98.3	135.7	0.67	50	7

7 **The Poisonous Properties of the Two-Grooved Milk Vetch (*Astragalus bisulcatus*).** — Beath, O. A. and Lehnert, E. H., in the *University of Wyoming, Agricultural Experiment Station, Laramie, Wyoming, Bulletin* No. 112, pp. 58-67, 1 fig. Laramie, January, 1917.

As *Astragalus bisulcatus* is not mentioned as a poisonous plant, the above ulletin gives an account of it to warn stockmen of its poisonous nature. grows in plains and valleys in the Rocky Mountain region. Milk vetch possibly most dangerous when fully mature but, when dry (as hay), it ems more or less harmless. Experiments carried out at the Wyoming gricultural Station have lead to the conclusions given below.

Milk vetch is certainly poisonous to cattle; its effect upon sheep is

uncertain ; 80 to 90 % of the animals affected die. Water easily removes the active poison from green or air-dried material. All parts of the plant contain poison, with a slight excess in the leaves. The poison is neither precipitated by basic acetate of lead nor decomposed at 100° C. ; it loses its toxicity on boiling with dilute acids, indicating its probable glucosidic character, as does the fact that a crystalline substance has been isolated giving reactions of glucosides ; at any rate, it is non-alkaloidal.

Thus far no chemical antidote has been found. When sufficient poison to cause death is introduced into the system, whether through the stomach or intravenously, it is quickly absorbed and soon produces symptoms of paralysis, by its action on the nervous system ; the action of the heart is also interfered with, and the poison no doubt kills by acting on this organ ; therefore drugs that stimulate the heart and the nervous system (alcohol, aromatic spirits of ammonia, belladonna extract, tincture of digitalis) should prove beneficial; these remedies should be preceded by a dram of 1 to 2 lbs. of Epsom salts.

308 – **Experiments on the Reported Poisonousness of Wild Melon Fruit.** — DODD, SIDNEY, in *The Agricultural Gazette of New South Wales*, Vol. XXVIII, Pt. 2., pp. 815-[illegible] Sydney, November 2, 1917.

Many Australian stock-owners believe the fruit of the wild or "paddy melon (*Cucumis myriocarpus*) to be poisonous to livestock, causing injury to the nerves and blindness. The green part is also said to be harmful, but because it is indigestible rather than poisonous. In South Africa this fruit has been reported as poisonous to sheep and, in one case, as having caused the death of a child. Both in Australia and South Africa several feeding experiments have been made in which the wild melon was fed to animals, but contradictory and inconclusive results were obtained, because the fruit was eaten for a short time only, and as the disease it causes is chronic, it results only after it has been fed for a prolonged period. The ripeness of the fruit must also be taken into consideration, as some stock-owners assert that it is injurious only before it is ripe. In some districts the drovers gather the fruit to give to their horses.

The author carried out two series of experiments in which wild melon fruit was fed to three guinea-pigs, two rabbits, a sheep and a horse. Two of the guinea-pigs, fed on unripe fruit, died, the other guinea-pig and the rabbits, after eating the fruit for about a month remained healthy and normal. The sheep was forcibly fed with the fruit for 20 days without showing any sign of poisoning ; on the 21st. day it was asphyxiated through the carelessness of the attendant. The horse was fed for 51 days with wild melon mashed up with bran, in amounts of about 2 lbs. 2 oz. per day, then of about 4 ¼ lbs. per day. It showed no sign of disease.

It seems as if the ripe fruit of wild melon may be considered harmless, but the author does not consider his results conclusive and intends to continue the investigations.

309 – **Pyotherapy in the Treatment of Harness Wounds ; Some Considerations on the Efficacity and Absolute Non-Specificity of Anticryptococcal Pyotherapy on the Horse.** — VELU H., in the *Bulletin de la Société de Pathologie exotique*, I, Vol. X, No. 10, pp. 901-903. Paris, December, 1917. — II. Vol. XI, No 1, pp. 12-17. Paris, January, 1918.

I. — In the course of researches on the pyotherapy of epizootic lymphangitis (1) the author has repeatedly found how efficacious is treatment with polyvalent vaccines (either anticryptococcal vaccine, or vaccine prepared from ordinary suppurations) for curing *non-specific* lesions, caused by harness.

During the negative phases, the peripheral inflammatory reaction becomes intense ; the separation furrow forms more quickly ; the necrosis tissue is eliminated more easily, on account of the increased suppuration ; surgical intervention becomes more easy, and the wound clears up without useless decay. During the positive phases, the wound cicatrises almost without suppuration, with surprising regularity and quickness. Local antiseptic treatment becomes almost accessory.

The author states that he has, by means of pyotherapy, rapidly cured arthritis and a severe traumatic synovitis, as well as obstinate bony fistulae. LIGNIÈRES (Bacteriotherapy in the treatment of Wounds, *Bulletin de la Société Centrale de Médecine Vétérinaire*, 1915, pp. 544-548) has already pointed out that specific organisms are not the only ones that give good results when injected into sick subjects. An antianthrax vaccination may stay the spread in a herd of a disease in no way connected with anthrax ; wounds that wont heal may do so after injection of an organism unconnected with the disease, such as *B. coli* On the other hand it is well known that the injection of any antigen is followed by a hyperleucocytosis.

In conclusion, pyovaccine provides a very efficacious, simple and economic method within the reach of all practitioners, for reducing, in considerable proportions, the time lost in laying-up for harness wounds.

II. — The polyvalent anticryptococcal pyovaccine prepared at the Casablanca Laboratory has been used for treating pyogenous lesions of the horse due to pathogenic agents other than the cryptococcus. The results clearly showed the definite action of the pyovaccine.

In every case, the injections brought about decreased local inflammation, less pain, the diminution, then disappearance, of suppuration, and in certain cases, sterilisation of the lesions. Their non-specific effect is undoubted, even when they do not bring about complete recovery.

The author quotes work of other experimenters on other vaccines, showing their non-specific action, and he concludes, speaking generally, that polyvalent, paraspecific pyotherapy is a very simple and economical method which, whether by results already obtained, or those rightly expected, should take a prominent place in the practice of veterinary therapeutics.

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(1) See *R.*, July 1917, No. 611 ; *R.*, August 1917, No. 734 ; *R.*, February 1918, No. 176 ; and No. 310 of this *Review* (*Ed.*)

310 – **The Curative Treatment of Epizootic Lymphangitis by Vaccinotherapy; Preparation of a Polyvalent Pyovaccine.** – I. VELU, H., in the *Recueil de Médecine Vétérinaire publié à l'Ecole d'Alfort*, Vol. XCII, No. 9 and 10, pp. 195–204. Paris, 1917. – II. IDEM, in the *Bulletin de la Société de Pathologie Exotique*, Vol. X, No. 8, pp. 681–684. Paris, 1917. — III. IDEM, in *Ibid*, Vol. XI, No. 1, pp. 10–11. Paris, 1918.

Work carried out at the Research Laboratory of the " Service de l'Elevage du Maroc " at Casablanca..

I. — The vaccine is obtained from pus from diseased horses and is, thus, an " anticryptococcal pyovaccine ". The subcutaneous injection causes, more or less rapidly, a reaction of the organism shown by very clear clinical signs at the level of the specific lesions. First appears a *negative phase* (aggravation of all the symptoms), which is then replaced by a *positive phase*.

The question of treatment consists in finding out suitable doses, and the frequency of renewal, so as to cause insignificant negative phases and predomination of positive ones.

The author gives results obtained with sick horses, and describes the broad lines of his method, which has given excellent results.

II. — After new clinical observations on over 100 animals for over 6 months, the author, having slightly modified his method, gives the final technique as follows: —

1) Injections of pyovaccine cause a reaction with effects localised at the level of the lesions. There is a negative phase. Therefore, all lesions containing pus should be punctured from the start.

2) Subcutaneous injections of pyovaccine sometimes cause abcesses that heal slowly ; for this reason, intravenous injections are advised, as giving quicker and more certain results.

3) The first 2 injections of pyovaccine, and especially the second, in strong doses (4 to 6 cc. for the first, 1.5 to 2.5 cc. for the second), produce intense and lasting positive phases. The doses should, in consequence, be strong and separated by intervals of 8, 10 or even 12 days. The giving of another injection should be delayed until the moment when the positive phase begins to slacken, that is, when the improvement begins to decrease, but one should not wait longer than this.

4) After the second injection the organism is very sensitive. So, after the third injection, small doses of pyovaccine (0.75 to 1.25 cc.) must be given. Fresh injections should be given immediately the positive phase begins to weaken, *i. e.*, about every 5, 6, 7 or 8 days.

The author states that the effects of pyovaccination are not strictly specific, and that he has obtained, with anticryptococcal vaccine, excellent results in the treatment of obstinate fistulae or of considerable lesions that did not show the causal organism of epizootic lymphangitis.

III. — *Polyvalent* vaccines and serums are those that act against several species of organisms, and *polyethnic* vaccines and serums are those that act against several varieties of the same species. Under these conditions, pyovaccine prepared with products obtained from several horses suffering from epizootic lymphangitis, is a polyethnic anticryptococcal pyovaccine, for it solely contains cryptococci of different strains. In the open lesions o

e disease there are, besides the cryptococcus in abundance, numerous d abundant associations of bacteria that certainly play no unimportant art; a polyvalent pyovaccine can thus be prepared which will act both on yptococci and associated organisms.

The technique for preparing the vaccine is as follows: Remove the pus om closed lesions by means of a sterilised syringe, after cutting the hair id disinfecting the skin over the abcess; also remove with the syringe the is or serosity collected at the surface of open lesions, under the crusts vering them; read off the volume on the graduated syringe and empty to a sterilised flask containing a known quantity of ether and phenolated ysiological serum at 5 %; mix well by shaking; mix together the pus obined from several cases; add the quantities of ether and 5 % phenolated ysiological serum required to bring the vaccine to the ratio of 1 of pus to 5 of ether and 10 of phenolated physiological serum; filter through to 6 sheets of sterile gauze.

The vaccine thus obtained will be a polyvalent antipyogenous vaccine r treating, not only epizootic lymphangitis, but also various pyogenous ions of the horse.

- **Pyotherapy in Epizootic Lymphangitis; Researches in Italy.** — LANFRANCHI, A. and BARDELLI, P., in *Il Moderno Zooiatro*, Series V, Year VI, No. 12, pp. 261-275, diagrams 7. Bologna, December 31, 1917.

After summarising the work carried out by MANGAN, BELIN and ILV (1) on pyotherapy, the authors give a detailed description of their eatment of epizootic lymphangitis by means of pyotherapy, which has ven completely negative results. "In all the animals treated, whether the ions were slight, of moderate severity, or severe, the 2 series of 6 injecns (each of 2 cc. of pyovaccine) with an interval of 8 days, caused no minution of the progress of the disease"; even with subjects used as ntrols, during the experiment, it was found that the injections of pyoccine" have "accelerated and aggravated the disease". Therefore, cording to the authors, at the present state of our knowledge, autorapy and pyotherapy are not methods of treatment the use of which uld be advised in epizootic lymphangitis.

- **The Vitality of the Rinderpest Virus Outside the Animal Body under Natural Conditions.** — SHILSTON, A. W., in the *Memoirs of the Department of Agriculture in India*, Veterinary Series, Vol. III, No. 1, pp. 32 + IV plates. Calcutta, October, 1917.

Great uncertainty has existed in regard to the length of time that rinderst can exist outside the animal body, either under natural conditions or ion special measures are taken to preserve its vitality. On this account, e experiments described in the present Memoir, were designed to asrtain the duration of the vitality of the rinderpest virus 1) on ground in the en air, 2) in closed sheds, 3) in faeces, urine and mucous discharges, and in meat, blood and bones under varying natural conditions. To make the

(1) See also *R.*, 1917, No 734; *R.*, February 1918, No 177 and 178. (*Ed.*)

tests as complete as possible, they were carried out both at the Muktes Laboratory, 7 500 feet above sea-level, and, save the last one, at Bareil under plains conditions. The author condenses the results obtained, whic are described in detail, into the following general conclusions: —

At the Muktesar Laboratory, rinderpest infection was found to persi in certain buildings for 48 hours after the removal of the sick animals, bu not for longer periods; frequently infection was absent after shorter in tervals. Shaded ground, when contaminated by cattle suffering from rin derpest, was found to be infective to healthy stock 18 hours after the remova of the sick animals, but not after longer intervals. Ground entirely expose to direct sunlight did not remain infective beyond 8 hours.

In the plains, buildings were found to remain infective for 20 hour after removal of the sick animals, but were non-infective after longer inte vals. Shaded areas remained infective for 24 hours and those exposed direct sunlight for 6 hours after removal of the sick animals, but not longer periods of time.

The rinderpest virus was found to survive in mixed faeces and u protected from direct sunlight for periods up to 54 hours after excretion sick animals, but when exposed to sunlight the virus did not survive more than 8 hours. Saliva and nasal discharge from sick animals did remain infective beyond 44 hours.

It may thus be concluded that, in buildings and areas infected by natural discharges of sick animals, the rinderpest virus is unable to surv for more than 2 or 3 days, and when air and sunlight are freely admitted destruction is even more rapid.

The carcasses of animals that have died from the disease must, howev be regarded as possible sources of infection for some considerable time ter death, especially when the air temperature is low, as it has been sho that the virus can survive for 51 days in blood from a sick animal even wh this has been freely exposed to the air and allowed to become putrid in meat and bones also the virus may persist for many days.

313 – **Tuberculosis in Camels, in Egypt.** — MASSY, F. E., in *The Agricultural Journal Egypt*, Vol. VII, pp. 6-11, Plates. Cairo, 1917.

Tuberculosis appears rarely to affect camels outside Egypt, but in th country it has long been known. In 1911, 1.63 % of the camels slaughter at the Cairo abattoir were found to be tuberculous, while for 1915 the pe centage was 5.4. These figures are certainly higher than those for th entire infection in Egypt.

The author ascertained the cause of the disease by indentifying the ca sal bacillus; controlled by inoculations in guinea pigs. The bacillus appea to be of the bovine type.

(1) In view of the statements made by various authorities that the rinderpest virus n not survive in drawn blood more than a day or two, it may be mentioned that in a very lar number of observations made at the Muktesar Laboratory, defibrinated blood stored und aseptic conditions at room temperature remained virulent for from 30 to 40 days and in case, blood kept at 0°C. was virulent after 90 days. (*Author*).

The author thinks that infection takes place primarily from cattle, the method being by inhalation. About 60 % of the tuberculous camels are only affected in the lungs, bronchial and mediastinal glands. The disease is never found in camels from countries where they do not come in contact with cattle. The subcutaneous test with ordinary tuberculin can be successfully employed on suspected camels.

14 - **Animal Calorimetry: The Interrelation Between Diet and Body Condition and the Energy Production during Mechanical Work.** — ANDERSON, R. J. and LUSK, GRAHAM (Physiological Laboratory, Cornell University, N. Y.), in *The Journal of Biological Chemistry*, Vol. XXXII, No. 3, pp. 421-435 + 10 tables. Baltimore, December, 1917.

Previous work on this subject showed that the heat produced by a given quantity of mechanical work was the same whether a man were fasting or had partaken liberally of a mixed diet (VOIT, 1866). Other experiments on men have shown mechanical work to be more easily performed after ingestion of saccharose than after ingestion of meat. This lead to the conclusion that there is a summation of the two energy increments due respectively to work and food ingestion (RUBNER, 1910; BENEDICT and MURCHHAUSER, 1915).

The authors extended these experiments to the dog, in which dietary control is easier than in man. The experiments dealt with the influence of meat or glucose ingestion upon the heat production of a dog running at the rate of about 3 miles an hour ; and the influence of fasting upon the quantity of energy required to do a given amount of mechanical work.

METHOD. — A treadmill with a moveable platform was specially constructed to permit of the use of the Williams calorimeter (described by the designer in *The Journal of Biological Chemistry*, Vol. XII, p. 371 ; 1912). This calorimeter is a breathing apparatus specially designed for experiment on small animals ; it is based on the REGNAULT type of calorimeter, improved and supplied with triple walls which allow very close observation of the slightest changes in temperature. Each revolution of the wheel operating the treadmill represents a forward movement of 0.458 m., and every 1 000 revolutions produce 0.5 calories by friction in the box of the calorimeter. The speed was kept constant during each hour of the experiment. The "standard diet" given was composed of 100 gm. of powdered biscuit, 20 gm. of lard., 100 gm. of beef ; to this daily ration were added 10 gm. of bone ash. (GRAHAM LUSK, Animal Calorimetry, *Journal of Biological Chemistry*, Vol. XIII, p. 185, 1912-1913). The basal metabolism was determined 18 hours after the administration of the standard diet when the dog was resting in the calorimeter at a temperature of 20°C. In the first series of experiments the basal metabolism was 17.5 calories per hour, and in a second series, where the average of the different hours was calculated, it was 17.2 calories.

INFLUENCE OF MECHANICAL WORK 18 HOURS AFTER INGESTION OF STANDARD DIET. — The quota of heat production due to muscular activity was found by subtracting the basal metabolism from the total metabolism determined during the work. The results given in Table I A. show that, 18 hours after ingestion of the standard diet, a dog weighing about 9 kg.

covering a distance of 3.9 to 4.8 km. per hour, did this work with an expenditure of energy equal to 0.580 kilogrammeter (to move 1 kgm. 1 meter). Although the weight of the dog varied 17 % during the experiments, and the speed of the treadmill 20 %, the maximum difference in energy expended was 1.7 %. (It will be seen that there is a relation between the weight of the animal and the energy required to move its body horizontally; a 15 % gain in weight caused a corresponding gain of 15 % in the energy requirement).

TABLE I. — *Influence of mechanical work.*

	Date (1917)	Food gm.	Experiment No.	Weight of dog	Indirect calorimetry (cal.)	Respiratory quotient	Work in meters travelled	Calories above the basal per 1000 meters travelled	Kilogram-meters required
			8 hours after ingestion of standard diet.						
A	January 5	—	2	8	60.8	0.78	3 925	11.0	0.583
	Feb. 28	—	8	9	70.0	0.81	4 300	12.3	0.581
	March 13	—	18	8.9	74.8	0.75	4 688	12.2	0.585
	» 23	—	24	9.2	76.7	0.74	4 717	12.6	0.562
	» 27	—	27	9.4	76.7	0.81	4 718	12.6	0.574
			13	9.0	76.1	0.79	4 806	12.2	0.578
			During the hours immediately following ingestion of glucose.						
B	January 5	Glucose, 70	3	8.35	62.3	0.98	3 936	11.1	0.579
	March 15	Glucose, 70	19	9.6	77.1	0.92	4 771	12.5	0.555
	» 26	Glucose, 100	26	9.7	76.8	0.95	4 737	12.5	0.550
			4 or 5 hours after ingestion of meat.						
C	January 11	Meat, 700 gm.	6	9.25	82.1	0.82	4 101	15.8	0.71
	March 6	No food.	13	9.0	76.1	0.79	4 806	12.2	0.57
	» 12	Meat, 750 gm.	17	9.6	92.4	0.80	4 704	16.0	0.75
	» 10	Meat, 750 gm.	16	9.5	* 30.6	0.80	—	—	—

* *Dog resting.*

INFLUENCE OF MECHANICAL WORK DURING THE HOURS IMMEDIATELY FOLLOWING THE INGESTION OF GLUCOSE. — The same dog after the ingestion of 70 or 100 gm. of glucose in water did the same amount of work with an energy expenditure of 0.550 kilogrammeters (see Table I B.) Thus, to supply the same amount of mechanical work, the dog, immediately after the ingestion of glucose, requires about the same amount of energy (slightly

ess) than when it does the work 18 hours after ingestion of the standard diet. t may, however, be said that, in spite of the addition to the weight of he dog of the aqueous solution ingested which increased the total weight o be deplaced, the expenditure of energy was only 0.550 kilogrammeters; his figure, compared with the preceding one (0.580 kilogrammeters), shows hat the ingestion of carbohydrates diminishes the energy required for given piece of work by 5 %.

INFLUENCE OF MECHANICAL WORK 4 OR 5 HOURS AFTER THE INGESTION F MEAT. — *The results obtained after the ingestion of meat* (see Table I C.) re in perfect agreement with those found by RUBNER in his experiments n man referred to above. The dog, 4 or 5 hours after the ingestion of eat, accomplished the work with an expenditure of energy exceeding the asal metabolism; this energy results from the sum of the specific dynamic. ction (1) of meat + the energy necessary for the work, the total being qual to an average of 0.587 kilogrammeters.

The ingestion of alanine (20 gm.) gives similar results, *i. e.* an energy penditure resulting from the specific dynamic action of the substance and e work supplied.

TABLE II. — *Influence of mechanical work upon metabolism in fasting.*

Date (1917)	Experiment No.	Weight (kg.)	Days of fast	Indirect calorimetry (cal.)	Respiratory quotient	Work in meters travelled	Calories above the basal per 1000 meters travelled	Kilogrammeters required
arch 29	28	8.75	3	73.7	0.71	4 796	12.06	0.584
» 30	29	8.6	4	16.0	0.74	—	—	—
» 31	30	8.55	5	70 2	0.724	1 719	11 5	0.570
ril 2	31	8.35	7	15.0	0.74	—	—	—
3	32	8.1	8	14.3	0.715	—	—	—
			9	70.8	0.710	*5 023	11.2	0.587
5	33	8.2	9	14.4	0.73	—	—	—
9	34	7.6	13	12.4	0.75	—	—	—
»	—	—	13	62 7	0.717	* 1 715	10.6	* 0.505

* Average = 0.584 kilogrammeters.

INFLUENCE OF MECHANICAL WORK DURING FASTING. — The dog having ost about 20 % of its weight after 13 days' fasting, performed the same echanical work with an average expenditure of energy of 0.584 kilogram-

(1) Term used by RUBNER to express the loss of energy peculiar to certain foodstuffs used by the changes they undergo in the organism. (See *B.* 1911, p. 435, ZUNTZ, N. *Experiments and Points of View in the Study of Animal Metabolism with the Aid of the Respiratory Apparatus.* (*Ed.*)

meters (see Table II). If the results obtained during fasting are compared with those obtained when the animal is in the best nutritive condition (see Table I) it is seen that, to accomplish the same amount of work, the same expenditure of energy is required in both cases, in spite of the fact that, in the first, the dog has lost 20 % of its weight.

CONCLUSION. — To move 1 kilogram of body substance 1 meter through space the animal requires a *constant* expenditure of energy (0.580 kilogrammeter on the average), *independent* of its weight and of the specific dynamic action of the foods ingested. Only an abundant supply of glucose reduces slightly this expenditure.

315 - **The Effect of High Temperature on the Nutritive Value of Foods.** — HOGAN, ALBERT G., in *The Journal of Biological Chemistry*, Vol. XXX, No. 1, pp. 115-123 + 0 diagrams. Baltimore, May, 1917.

The experiments described were made on rats in the Department of Chemistry of the Kansas Agricultural Experiment Station, Manhattan.

In a previous paper (*Journal of Biological Chemistry*, Vol. XXVII, p. 193, 1916) the author showed that young rats are unable to grow on a diet that has been subjected to high temperatures. Many investigators believe the so-called accessories to be destroyed by exposure to heat. In order to verify this hypothesis the author undertook new experiments, using as food maize and a mixture of maize and white of egg, one or both of which had been heated in the autoclave for 6 hours under a 30 lbs. pressure. It was found that heat had little or no effect on the white of egg, but that each time the maize was heated the diet became inadequate in some respect. To ascertain whether the protein had been changed, a relatively pure protein — white of egg — was heated in the autoclave for 6 hours at a 30 lbs. pressure. This protein was carefully dried and mixed with protein-free milk, butter, starch and agar in such proportions that the protein formed about 9 % of the ration. In further experiments, for the white of egg was substituted unheated casein (control) and casein heated in the autoclave for 2 hours under a pressure varying from 15 to 45 lbs. It was seen that the action of heat caused no essential modification of the food value of either the white of egg or the casein.

The author concludes that heating such as carried out in his experiments does not materially decrease the food value of proteins. The hypothesis that one or more of the so-called food accessories may be injured by high temperatures seems justified.

316 - **The Supplementary Dietary Relationship between Leaf and Seed as Contrasted with Combinations of Seed with Seed.** — MCCOLLUM, E. V., SIMMONDS, N. and PITZ, W., in *The Journal of Biological Chemistry*, Vol. XXX, No. 1, pp. 13-32 + 14 diagrams. Baltimore, May, 1917.

At the Agricultural Station of Wisconsin, Madison, the authors had previously carried out a series of preliminary feeding experiments with a number of natural foods of one variety completed by the addition of one or more isolated and chemically pure dietary factors (protein, mixture of

inorganic salts, fat-soluble A, water-soluble E*). In this way they studied wheat (1) maize (2), rice (3), oat kernels (4) and white beans (5).

With the exception of polished rice and beans these seeds resemble each other closely in their dietary properties: — *a*) the proteins are of relatively, poor quality furnishing certain essential amino-acids in amounts below the optimum; *b*) the content and composition of the inorganic portion of each seed are of a character which cannot induce normal growth and must be corrected by certain salt additions; *c*) the content of the fat-soluble A is inadequate to supply the needs of a growing animal over a prolonged period. Unpolished rice closely resembles the other seeds mentioned above, but polished rice, which has lost both its bran layer and its germ, is deficient, not only in the above-mentioned factors, but also in water-soluble B. The common bean differs from the other seeds particularly in the poor quality of its proteins. These contain but little of one or more of the essential amino-acids, so that beans should always be combined with other natural foods capable of supplying the proteins which supplement this deficiency.

In the paper under review the authors give data obtained recently which clearly show the general lines along which successful nutrition may be obtained when the diet is purely vegetarian. Their experiments, which have lasted over 10 years, carried out with rats and pigs, convinced them that these two species have essentially the same food requirements. Neither species can grow satisfactorily when restricted to one of the cereal grains; as regards growth and reproduction both respond in the same way to specific modifications of a diet thus restricted. In the experiments described, made with rats, it was found impossible to make up a ration derived solely from the seeds of plants capable of giving normal nutrition during the growing period, even though two to five seeds of widely different varieties were employed. When the animals were put on a simple and unvaried diet of a mixture of leaves (alfalfa) and seeds, very different results were obtained.

It was impossible to secure appreciable growth with the following mixtures of seeds with salt-free water.

1) maize 90, flaxseed oil meal 10;

2) wheat 20, maize 20, rolled oats 20, hemp seed 20, millet seed 20;

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(1) HART, E. B., MCCOLLUM, E. V., STEENBOCK, H. and HUMPHREY, G. C., *Wisconsin Agricultural Experiment Station Research Bulletin* 17, 1911; HART and MCCOLLUM, *Journal of Biological Chemistry*, Vol. XIX, p. 373, 1914; HART, E. B., MILLER, W. S. and MCCOLLUM, E. V., *ibid.*, Vol. XXV, p. 239, 1916; MCCOLLUM, E. V., SIMMONDS, N., and PITZ, *ibid.*, Vol. XXVIII, p. 211, 1916-1917. — (2) HART and MCCOLLUM, *Journal of Biological Chemistry*, Vol. XIX, p. 373, 1914; MCCOLLUM, SIMMONDS and PITZ, *ibid.*, Vol. XXVIII, p. 153, 1916-1917. — (3) MCCOLLUM, E. V. and DAVIS, M., *Journal of Biological Chemistry*, Vol. XXIII, p. 181, 1915. — (4) MCCOLLUM, SIMMONDS and PITZ, *Journal of Biological Chemistry*, Vol. XXIX, p. 341, 1917. — (5) MCCOLLUM, SIMMONDS and PITZ, *Journal of Biological Chemistry*, Vol. XXIX, p. 521, 1917.

See also *B.* March, 1915, No. 296. (*Ed.*)

* For the explanation of these terms see *R.* Jan., 1918, No. 2. (*Ed.*)

3) wheat 25, maize 25, rolled oats 25, hemp seed 25 ;

4) wheat 33, maize 33, rolled oats 33.

These rations represent two distinct types ; rations 1 and 2 promote good growth if suitable inorganic salts are added, but not otherwise ; ration 3, after a period of suspended growth, responds less well to the addition of salts in its effects than the two preceding rations ; ration 4 does not support growth. This shows that rations 1 and 2 contain a sufficient quantity of the factors fat-soluble A and water-soluble B, as well as proteins of adequate quality and enough assimilable energy as carbohydrate and fat. The preceding experiments (described above) showed that maize, wheat and oats contained an insufficient amount of the fat-soluble A, and it is, therefore, evident that flaxseed meal and millet seed contain a much greater

Inorganic constituents of vegetable foodstuffs (per cent.)

Vegetable	Ash	K	Na	Ca	Mg	P	Cl
Leaf							
Alfalfa hay	7.38	1.64	0.01	2.14	0.22	0.34	0.29
Rape green	8.08	2.23	0.23	1.26	0,18	0 40	0.61
Red Clover	6.86	1.84	0.10	1.71	0.45	0.24	0.26
Rhubarb	14.49	7.14	0.55	1.04	—	0.93	0,77
Spinach	16.48	2.27	4.32	1.40	0.63	0.74	1 04
Cabbage heart	10.85	2.51	0.80	1.66	0.23	0.71	0 85
Seed							
Hulled rice	0 39	0.07	0.016	0.009	0.026	0.07	0.070
Maize	1.55	0.32	0.05	0.01	0.12	0 33	0 045
Wheat	2.08	0.50	0 02	0.04	0.14	0 40	0.06
Oatmeal	1.83	0.36	0 06	0.01	0.09	0.38	0 10
Beans	3.63	1.25	0.03	0.13	0.16	0.61	0.06
Cottonseed meal (extracted with solvents)	7.48	1.85	—	0.23	0 68	1.50	0.005
Linseed meal (extracted with solvents)	5.84	1.18	0.07	0.35	0.55	0.80	0.04
Tuber or root.							
Potato	3 79	1.91	0.08	0.07	0.11	0.28	0.13
Sweet potato	3.07	1.28	0.15	0.22	0.06	0.14	0.39
Beet	5.97	0.84	2.16	0.25	0.01	0.25	0.29
Turnip	8 01	3.02	0.58	0.60	0.18	0.14	0.43
Fruit							
Oranges	3.08	0.93	0.31	0.54	0.15	0.15	0.07
Apples	1.44	0.43	0.28	0.04	0.07	0.08	—
Plums	2 08	1.20	0.03	0 06	0.06	0.12	0.06
Raisins	2.86	1.10	0.16	0 10	0.10	0.22	0.12
Figs	2.92	1.35	0.05	0.23	0.10	0.15	0.06

ount of this dietary factor. This is confirmed by the results obtained h ration 3 which contains neither flaxseed meal nor millet seed. Ration s deficient, not only in the fat-soluble A, but also in salts.

It is difficult, if not impossible, to obtain even moderate growth over an ended period on a diet restricted to the seeds of plants. Since the water- uble B is abundant in all the seeds, and the fat-soluble A present in large antities in some of them, the failure of the seeds to promote growth must attributed to the composition of their inorganic fraction. Of the seven ds most important for human nutrition and animal production (rice, ize, wheat, oats, beans, cotton, flax) only cottonseed and flaxseed have high inorganic content, and in all of them, as with seeds in general, the h is very poor in sodium, calcium and chlorine.

The following data are taken from the paper by E. B. FORBES, *Ohio Agri- ltural Experiment Station Bulletin* 207, 1909.

The leaf and seed rations used to ascertain how far leaves can supple- nt the deficiencies of the seeds were : —

5) rolled oats 50, alfalfa 50 ;
6) rolled oats 60, alfalfa 40 ;
7) rolled oats 70, alfalfa 30 ;
8) wheat 60, alfalfa 40 ;
9) wheat 70, alfalfa 30 ;
10) maize 60, alfalfa 40 ;
11) maize 70, alfalfa 30 ;
12) maize 80, alfalfa 20 ;
13) maize 90, alfalfa 10 ;
14) peas 60, alfalfa 40.

The results obtained led to the following conclusions : —

The leaf is distinctly different from the seed in its dietary properties in respects: — its total inorganic content is very high, and it is especially in both sodium and calcium, both of which are deficient in the seeds gener- . In addition the leaf is several times richer in fat-soluble A than are eat, oat and maize kernels. Certain seeds contain this substance to rly the same extent as the leaf; hemp seed is distinctly superior in this pect to the seeds just mentioned, and flaxseed and millet seed are still ter than hemp seed. The fat-soluble A content is highest in the smallest ds, probably because of the relatively large proportion of germ contained them.

Indian Cattle Census. — *The Agricultural Journal of India*, Vol. XII, Part. IV, . 676, Pusa, October, 1917.

The following figures, recently published by the Director of Statistics dia are based on cattle censuses which are taken annually in some inces and quinquennially in others. It is stated that a general census ll provinces will be taken during the year 1919-1920.

The total number of cattle in British India is 147 336 000. Of this, and bullocks account for 48 664 710, cows for 37 481 273, buffaloes 9 025 079, and young stock for 42 184 790. The following are the incial figures: —

United Provinces	31 741 000	22 % of total	Burma	5 882 000	0 % of total
Bengal	25 324 000	17 % "	Assam	3 576 000	
Madras	21 761 000	15 % "	North-West Frontier Province	1 271 000	
Bihar and Orissa	20 119 000	14 % "	Ajmer-Merwara	351 000	
Punjab	15 480 000	11 % "	Dehli	148 000	
Central Provinces and Berar	11 857 000	8 % "	Coorg	131 000	
Bombay and Sind	9 677 000	7 % "	Manpur	6 000	

The number of cattle per 100 acres of cropped area ranges between 32 in Bombay and Sind and 100 in Bengal, while the number per 100 of population ranges between 36 in Dehli and 95 in the Manpur Pargana. The average for British India as a whole is 65 per 100 acres of cropped area and 61 per 100 of population.

The number of sheep is given at 23 015 836, of which Madras possesses 10 765 543 and the Punjab 4 676 899. The number of goats was 33 338 467, horses and ponies, 1 653 379, and mules and donkeys, 1 512 205.

The statistics relating to sheep, goats, horses, and ponies, and mules and donkeys, exclude Bengal, from which no returns regarding these animals are at present received.

318 – **Herd Books of the Argentine Rural Society** (1). — DE ANCHORENA J., in the *Anales de la Sociedad Rural Argentina*, Year L, II, Vol. I, I, pp. 642-644. Buenos Ayres, October 1917.

The appended tables give a summary of the entries in the herd books of the Argentine Rural Society for the last year (October 1, 1916-September 1917) and since their foundation. All pure breeds of cattle, horses, asses, sheep and pigs, whether produced in or imported into the Argentine are included.

A. *Argentine Herd Book.*

Breeds.	Entries from October 1, 1916 to September 35, 1917					Entries since foundation.		
	Imported animals		Animals born in the country		Total	Imported and home-bred animals		
	Males	Females	Males	Females		Males	Females	Total
Shorthorn	638	79	4 671	4 512	9 930	50 640	53 123	103 7
Hereford	16	—	725	800	1 541	9 354	11 541	20 9
Aberdeen Angus	42	23	492	458	1 015	4 543	4 806	9 3
Red Shorthorn	1	—	6	5	12	145	201	3
Red Polled	—	—	12	13	25	111	125	2
Devon	—	—	5	3	8	20	23	
Jersey	—	—	9	8	17	44	51	
Flemish	—	—	33	22	55	167	487	6
Totals	697	102	5 953	5 851	17 603	22 024	70 410	135 4

(1) See *R.*, February, 1916, No. 202. (*Ed.*)

B. Argentine Stud Book.

Breeds	Entries from October 1, 1916 to September 30, 1917			Entries since foundation		
	Males	Females	Total	Males	Females	Total
rcheron	285	383	668	2 605	5 878	8 483
ydesdale	129	199	328	1 975	4 890	6 865
ire	118	165	283	1 721	3 364	5 085
ckney	123	120	243	1 923	2 804	4 727
rkshire	25	27	52	287	731	1 018
glo-Norman	10	21	31	192	671	863
ffolk-Punch	9	4	13	190	523	713
ulonnais	8	4	12	152	197	349
nter	9	22	31	62	173	235
ff	--	--	--	87	110	197
lo-Pony	6	7	13	66	86	152
lgian	--	3	3	21	73	94
tland-Pony	--	--	--	10	24	34
erican-trotting	2	--	2	7	23	30
denburg	--	1	1	10	16	26
lstein	--	2	2	10	13	23
Totals	**124**	**958**	**1 682**	**9 318**	**19 576**	**28 894**

C. *Argentine Ass Book.*

Breeds	Entries from October 1, 1916 to September 30 1917		
	Males	Females	Total
a	26	92	118
ma	23	69	92
Total	**49**	**161**	**210**

D. — *Argentine Flock Book.*

Breeds	Entries from October 1, 1916 to September 30, 1917					Total breeding animals entered in the final register and preliminary to the same period			
	Imported animals		Homebred animals		Preliminary register.	Final		Preliminary	Total
	Males	Females	Males	Females	Females	Males	Females	Females	
Lincoln	702	50	1 495	1 694	1 016	2 927	8 858	9 745	21 531
Argentine Merino	4	9	486	423	—	1 317	8 155	—	4 472
Shropshire Down	24	—	13	13	18	71	342	152	565
Hampshire Down	5	—	66	87	29	124	367	211	792
Oxford Down	18	3	85	80	306	84	326	1 033	1 448
Romney Marsh	44	—	193	253	86	175	847	594	1 416
Border Leicester	—	—	34	52	—	30	180	—	216
Dixley	—	—	3	3	—	3	3	—	6
Corriedale	—	—	—	—	—	1	—	5	51
Total	795	59	2 375	2 624	2 455	4 741	14 078	11 585	30 011

R. — *Argentine Swine Book.*

Breeds	Entries from October 1, 1916 to September 30, 1917			Entries since foundation		
	Males	Females	Total	Males	Females	Total
Berkshire	679	961	1 640	4 895	6 247	11 142
Middle White Yorkshire	183	134	257	1 511	2 023	3 534
Tamworth	88	159	244	170	301	471
Large Black	102	122	230	1 274	1 400	2 674
Duroc-Jersey	22	30	52	58	71	129
Poland-China	—	—	—	111	134	245
Large White	—	—	—	43	67	101
Hampshire	—	—	—	4	6	10
Total	1 017	1 406	2 423	8 066	10 269	18 335

319 – **The Stud Beef Cattle Breeders' Association of Australia.** — *The Pastoral Review.* Vol. XXVII, No. 10, p. 933. Melbourne, October 16, 1917.

The movement initiated in Sydney about three months ago in the direction of forming a stud beef cattle breeders' association received official endorsement when the members of the *Stud Beef Cattle Breeders' Association of Australia* met in general meeting to consider and adopt the rules and regulations drawn up by the provisional council.

The future value of the organisation in fostering pure cattle breeding was generally recognized, as well as the fact that the opportunities of doing

valuable work in this direction in Australia are boundless. The men who have been elected to manage this new Association are well-known and successful breeders from the various States of the Commonwealth and are fully competent to make it an unqualified success.

320 - **On the Use of Certain Marine Algae for Feeding Horses.** — ADRIAN, in *Comptes rendus des Séances de l'Académie des Sciences*, Vol. CLXVI, No. 1, pp. 54-56. Paris, January 7, 1918.

The author, having been offered a product obtained from Laminarias to be used for waterproofing cloths, noticed that the composition of the treated seaweed resembled that of oats, as is shown by the appended figures: —

	Laminarias treated	Oats
Water	14.40 %	12.55 %
Carbohydrates	52.90	66.80
Nitrogenous matter	17.30	9.10
Cellulose	11.50	8.45
Ash	3.90	3.10

The author tried the product on 2 lots of 3 horses suffering from lymphangitis; one lot, used as control, was given the ordinary feed of oats, hay, straw, while for the second the seaweed replaced the oats.

After 24 days, it was found that the horses fed on seaweed had increased in weight by 6 %, while their general condition was much improved, and the lymphangitis had disappeared, though still persisting in the first lot. This action on the disease, if it is confirmed, might possibly be due (according to MM. LAPICQUE and LEGENDRE of the Museum, who were consulted on this question) to the traces of organic iodine in the algae.

One certain result was obtained: — horses had eaten, digested and assimilated the new food replacing oats.

A further experiment was tried with 2 lots of 20 cavalry horses; the first lot were fed normally, while the second received 1 kg. of alimentary seaweed replacing 1 kg. of oats.

The experiment, which lasted 2 months, confirmed the previous one; the horses fed on the seaweed had put on 13 kg. by the end of the trial, while the control horses had barely gained 2 kg.

The author considers 0.750 kg. of alimentary seaweed to be equivalent to 1 kg. of oats.

The experiment is all the more interesting since Laminarias are abundant on the coast of Brittany. The author discusses their use in human nutrition, as regards which very interesting results have been obtained.

321 - **Relation between the Weight of the Carcass and that of the Meat in Beef Cattle.** — DECHAMBRE, in *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. IV, No. 1, pp. 25-28. Paris, January 9, 1918.

The meat obtained from an animal is equal to the difference between the net weight and the total weight of the bones, suet, etc. The most

important of these factors is the carcass, a knowledge of which would form a sound basis for the selection of slaughter breeds.

The relation between the weight of the carcass and that of the meat is influenced by many factors, such as age, sex, breed, maturity, and, above all, the condition of the animal produced by the degree of fattening. The author's experiments to determine this relation were carried out with a large number of animals, representing a total weight of meat of 51 031 lbs. in quarters containing 9 788 lbs. of bone. The average ratio of bone to meat is, therefore, 19.18 %. The extent of fattening greatly influences this ratio. It is usually expressed by the yield per cent. in meat, which is the ratio between live weight and the weight of the quarters. In the meat studied the extent of fattening is dependent on the amount of suet removed for preserving. The author, therefore, determined this amount and calculated its ratio to the weight of the quarters. When this ratio is compared with that between the bone and meat, it is seen that the figures vary inversely: — the fatter the animal the lower the proportion of bone.

The author's conclusions are: — 1) in medium fat and fat cattle, which generally give a net yield of meat varying between 55 and 58 %, the ratio between bone and meat is between 16 and 18 % ; 2) in animals in good condition, yielding 50 to 52 %, the ratio is, on an average, 20 % ; 3) in animals yielding less than 50 % (47 to 49 %), the ratio rises to 22 %, or a little more (22.63 %), though still below the 25 % generally admitted in the meat trade.

322 – **A Statistical Study of Body Weights; Gains and Measurements of Steers During the Fattening Period.** — SEVERSON, B. O. and GERLAUGH, P., in the *Journal of Agricultural Research*, Vol. XI, No. 8, pp. 383-391 + Plates 38-39. Washington, D.C., Nov., 1917.

During the winter months of 1914-1915, 1915-1916 and 1916-1917, a series of body measurements of steers were made at the Pennsylvania Experiment Station, at the beginning and close of feeding experiments for three consecutive years, with the purpose of determining the average body measurements of 2-year-old steers at the beginning and close of the fattening period and the relationship of other definite body measurements to each other, and to note those measurements that could be used in selection as a means of reducing the experimental error in feeding experiments and a study of variation in the measurements themselves. Another object was to find out the correlation of gains to initial body measurements and to changes in body dimensions.

All measurements taken on a total of 216 animals divided into seven lots each year are indicated in Table I. These steers were relatively uniform as feeders, varying in market grades from "fair" to "choice", the majority being "good" feeders; 92 were Hereford grades, 84 Shorthorn grades, 18 Aberdeen Angus grades, 7 Shorthorn × Hereford crosses, 3 Shorthorn × Aberdeen-Angus crosses, and 3 Hereford × Aberdeen-Angus crosses. In no case did a steer fail to show some infusion of improved beef blood. The average initial weight of the 216 steers was 900.112 pounds with 700 and 1300 pounds as extremes. The steers

were as uniform in quality, weight, and condition as would ordinarily be obtained for feeding purposes. Each year 60 steers were divided into five lots of 12 each selected with as much care for uniformity of weight, breeding, condition and quality as possible. The feeding of these various lots was done with rations affording very nearly the same opportunity for gains in live weight and condition of flesh for marketing.

Table I includes all records for the three years, while the correlation tables include the data during the first two years. All body measurements except circumferences were made with the steel caliper; all circumferences were measured with a steel tape graduated in inches. The probability of error in measurements is a factor not considered, thus necessitating a larger number of measurements to reduce the probable error.

TABLE I. — *Average initial and final measurements of 2-year-old steers fattened for market during a 140-day feeding period.*

Measurement	Initial measurement.		Final measurement.		Difference in measurements	Percentage increase
	Number of steers	Average	Number of steers	Average		
		Pounds		*Pounds*	*Pounds*	
Weight	216	900 112	216	1.188.398	288.286	32.02
		Inches		*Inches*	*Inches*	
Width of head	214	8.832	216	9.112	0.280	3.16
Length of head	214	19.411	216	19.892	0.481	2.48
Length of neck	103	19.163	72	20.090	1.827	9.53
Width of shoulders	214	16.412	215	18.459	2.047	12.42
Width of front flank	214	16.378	216	18.358	1.980	12.08
Width of paunch	214	23.612	216	26.101	2.489	10.54
Width of rear flank	154	19.527	216	22.744	3.217	16.42
Width of loin	209	13.984	216	15.958	1.974	14.11
Width of hips	202	17.662	216	19.254	1.592	9.01
Width af thurls (Hip joint)	209	17.204	215	18.533	1.329	7.72
Buttock to hip	214	18.366	216	19.022	1.256	6.83
Depth of chest	154	26.730	215	27.789	1.059	3.96
Shoulder point to ground	214	33.033	216	34.311	1.278	3.86
Chest to ground	214	22.876	216	24.013	0.237	1.03
Hind flank to ground	214	29.128	216	30.202	1.074	3.68
Hock to ground	142	20.795	204	20.914	0.119	0.57
Withers to ground	214	49 224	216	53.870	4.646	9.43
Hips to ground	202	50.855	214	52.411	1.556	3.05
Shoulder to buttock	214	53.763	216	57.088	4.225	1.85
Circumference of chest	214	73.014	216	77.094	4.680	6.40
Circumference of paunch	214	80.256	216	88.301	8.045	10.02
Circumference of hind flank	214	71.364	216	78.685	7.321	10.25
Circumference of muzzle	141	17.198	143	17.930	0.832	4.83

These 216 steers gained at the rate of 2.058 pounds daily for 140 days. The following average initial measurements show a marked similarity: the length of head, length of neck, and width of rear flank, which

vary from 19.163 to 19.527 inches; the width of shoulder and front flan differ by only 0.034 inch; the hips and thurls (hip joint) in width are 17.68 inches and 17.204 inches, respectively; and circumference of the body i the region of the chest and hind flank are 73.014 and 71.364 inches respec tively. The height at the withers of a "feeder" steer is 1.631 less than th height at the hips. The length of body from shoulder point to buttock; only 2.908 inches greater than the greatest height at the hips.

The average measurements at the conclusion of the fattening perio show similarity as follows: The length of head, width of hips, and distanc of buttock from hips varying within 0.638 inch of each other; the width c shoulder, front flank, and thurls are almost identical; and the circum ference of the chest and hind flank are more alike than their initial measure ments.

The height has increased more at the withers than at the hips; thus a 2-year-old steer changes his greatest height from the hips to the withers while receiving market conditions. In circumference the increase was greater for the hind flank than for the chest; thus the greater circum ference of the chest at the initial measurement becomes less than the circum ference of the hind flank in the finished steer. In fattening, the greates width at paunch and the greatest depth of body at the chest become mor nearly alike, as shown by a difference of 3.118 inches at the initial measure ment and 1.688 inches at the concluding measurement.

In all cases the difference between the initial measurement and th final measurement shows an increase in dimensions due to depositions c fat, muscular development and growth. The regions of the body covere by the greatest amount of muscular development show greater increase dimensions than those having less muscular covering.

In the regions where the growth would show the greater relative in fluence the least changes take place as shown in the width of head, lengt of head, distance from chest to ground and hock to ground. The greates increase in width took place in the hind flank rather than in the paunch where it would seem natural to have the greatest increase because of fee capacity and condition. The thick layer of flesh and fat deposits in th region of the hind flank, together with the distension of this region of th body in a fattened steer, are responsible for the greater width in this par of the body. The width of loin, hips, thurls, shoulders, and front flank show changes in dimensions caused mainly by increased condition of flesh.

The increase in height at the withers of 4.646 inches is not all due t growth alone, a larger portion of this increase being caused by the flesh co vering over the withers and the deposition of fat in the muscular tissue of the shoulder region. The fat deposit and muscular development cause the shoulder blade to be held more rigidly; thus, the body in the ches region rises between the shoulder blades, as indicated by the greater distanc between the withers and the upper border of the shoulder blade. The great est change in the body measurements was the circumference of the paunch This, however, was proportionately less than the increase of 7.321 inche in circumference of the hind flank. The fact that the distance of chest t

ground and hind flank to ground did not show greater difference was due to lowering of the flank by deposition of fat in that region and the fat covering over the region of the chest. The region of the body possessing the most valuable eatable parts on the whole are affected most in the fattening process.

CORRELATION TABLES. The following table is here presented as illustration of the methods used in obtaining the facts presented in tables III and IV.

TABLE II. —*Correlation of average daily gain of steers during a feeding period of* 120 *to* 140 *days and the weight at the beginning of a feeding period.*

Daily gain (pounds)	Initial weight per steer (pounds)													Total
	1 300	1 250	1 200	1 150	1 100	1 050	1 000	950	900	850	800	750	700	
3.2	—	—	—	—	—	—	—	1	—	—	—	—	—	1
3.0	—	—	—	—	—	—	—	—	—	—	—	—	—	0
2.8	—	—	—	—	1	1	3	1	1	2	1	1	—	11
2.6	—	—	—	—	—	4	2	2	4	1	3	3	1	20
2.4	—	1	—	1	2	1	5	8	11	7	6	3	2	47
2.2	—	1	—	2	2	—	4	7	4	7	4	5	—	36
2.0	1	1	—	3	—	1	4	7	9	16	9	12	2	65
1.8	—	1	—	3	2	2	5	7	11	10	9	7	6	63
1.6	—	—	1	—	—	1	5	3	5	4	4	5	4	32
1.4	—	—	—	1	2	—	4	4	10	3	7	1	1	33
1.2	—	—	2	—	—	2	2	4	2	6	2	1	1	22
1.0	—	—	—	—	—	—	—	1	2	—	1	1	—	5
0.8	—	—	—	—	—	1	—	—	2	—	—	—	—	3
Total	1	4	3	10	9	13	34	45	61	56	46	39	17	338

Mean live weight	pounds 893.93	± 3.94
Mean daily gain	do. 1.95	∓ .016
Standard deviation of live weight	do. 106.88	± 2.777
Standard deviation of daily gain	do. 0.446	± .011
Correlation	do. 0.0364	± .036

The results shown in table III are based on data collected on steers during the two winter periods of 1914-15 and 1915-16. All measurements considered in this table are initial measurements, except those that show increases of dimensions at the close of the fattening period as compared with the initial measurements. The coefficient of variation is shown to be greatest on increases in circumference of hind flank, paunch, and chest, and the increase in gains in live weight.

These measurements all relate to increased dimensions and occur in those parts of the body that show relatively high percentage increase over initial body measurements (Table I).

Of the initial measurements the greatest coefficient of variation is 11.9 ± 0.04 per cent for initial live weight. In all the chest measurements the coefficients of variation are relatively high: Width at point of shoulder

9.3 ± 0.52, width of fore flank 10.4 ± 0.6, depth of chest 6.1 ± 0.34, and circumference of chest 6.9 ± 0.39. Likewise the mid and posterior regions of the body show variations, the rear flank with a coefficient of variation of 8.7 ± 0.48, circumference of rear flank 6 ± 0.34, width of loin 7.5 ± 0.43, width of thurls 5.9 ± 0.34, circumference of paunch 11 ± 0.62 and distance of hips to buttock 5.2 ± 0.29.

The measurements affected most by growth show the least variations and include the distance of shoulder point, rear flank, and withers from the ground, length of head, and distance of shoulder point to buttock.

In general Table III shows the greatest variation in those regions of the body which change most in a fattening steer and those regions affected most by deposition of fat and development of muscular tissue.

TABLE III. — *Means, standard deviations, and coefficients of variation presented in correlation tables.*

Number of steers	Measurements	Mean	Standard deviations	Coefficient of variation
		pounds	pounds	Per cent
388	Average daily gain	1.93 ± 0.016	0.446 ± 0.011	23.1 ± 0.84
388	Initial live weight	893.93 ± 3.94	106.88 ± 2.77	11.9 ± .04
142	Total gain in live waight	288.55 ± 3.10	54.77 ± 2.19	19.1 ± 1.08
		Inches	Inches	
142	Increase in circumference of chest	8.13 ± .10	1.87 ± .074	23.0 ± 1.30
142	Width of rear flank	19.25 ± .09	1.69 ± .06	8.7 ± .48
142	Circumference of rear flank	72.76 ± .25	4.40 ± .17	6.0 ± .34
142	Height of shoulder point	34.10 ± .08	1.57 ± .06	4.5 ± .25
142	Height of rear flank	30.23 ± .09	1.67 ± .06	5.5 ± .31
142	Distance, hip to buttock	18.69 ± .05	.99 ± .03	5.2 ± .20
137	Width of loin	13.96 ± .06	1.05 ± .22	7.5 ± .43
142	Circumference of chest	69.82 ± .22	3.91 ± .01	6.9 ± .39
142	Depth of chest	25.77 ± .08	1.59 ± .063	6.1 ± .34
142	Width of fore flank	15.02 ± .08	1.57 ± .06	10.4 ± .60
142	Distance, chest to ground	22.89 ± .06	1.18 ± .04	5.1 ∓ .28
136	Width of thurl	17.36 ± .05	1.03 ± .04	5.9 ± .34
142	Length of head	19.53 ± .04	.81 ± .03	4.1 ∓ .23
142	Length of shoulder to buttock	55.66 ± .17	3.02 ± 2.84	5.4 ± .30
142	Increase in circumference of paunch	8.26 ± .16	2.96 ± .11	35.8 ± 2.02
142	Height of withers	49.50 ± 1.07	1.95 ∓ .07	4.9 ± .27
142	Width at point of shoulder	16.42 ± .08	1.54 ± .06	9.3 ± .52
142	Circumference of paunch	81.60 ± .56	10.04 ± 4.02	10.0 ± .62
138	Increase in circumference of rear flank	7.52 ± .20	3.51 ± .14	46.6 ± 2.67

Table IV, a summary of the coefficients of correlation, shows that increases in body measurements have a closer relationship with gains in live weight than the initial measurements. With the exception of initial weigh

these measurements, as shown in Table II, also had high coefficients of variation.

The correlation coefficients for the two body circumferences of chest and rear flank, the width of thurls (hip joint), and the distance of hip to buttock show the closest relationship of all the initial measurements with gains in live weight. This suggests the possibilities of using these measurements in the selection of feeding steers, at least for experimental purposes, as a means of reducing the experimental error caused by individuality of animals.

The measurement of initial weight shows no relationship with gains, although this is usually considered one of the most important factors in selection of steers for experimental purposes.

Measurements that show intermediate relationship as indicated by coefficients of correlation are width of loin, depth of chest, width of fore flank, length of head, height of withers, circumference of paunch and width at shoulders.

TABLE IV. — *Summary of correlations.*

Correlating	Correlation coefficient	Correlating	Correlation coefficient
Gain whith initial live weight	0.036 ± 0.036	Gain with initial length of head	0.182 ± 0.037
Gain with increase in circumference of chest	.460 ± .044	Gain with initial length from point of shoulder to buttock	.020 ± .056
Gain with initial width of rear flank	.079 ± .083	Gain with increase in circumference of paunch	.306 ± .036
Gain with initial circumference of rear flank	.221 ± .053	Gain with initial heigth of withers	.163 ± .054
Gain with initial height of point of shoulder	.061 ∓ .056	Gain with initial width of shoulders	.144 ± .055
Gain with initial height of rear flanck	.053 ± .055	Gain with initial circumference of paunch	.124 ± .055
Gain with initial length of hip to buttock	.271 ± .053	Gain with increase in circumference of rear flanck	.203 ± .055
Gain with initial width of loin	.108 ± .085	Width of thurls with height of rear flank	.380 ± .049
Gain with initial circumference of chest	.238 ± .053	Circumference of chest with height of withers	.621 ± .034
Gain with initial depth of chest	.130 ± .046	Width of loin with height of chest from ground	.179 ± .057
Gain with initial width of fore flank	.164 ± .051	Width of chest with depth of chest	.365 ± .072
Gain with initial distance of chest to ground	.077 ± .056		
Gain with initial width of thurls	.224 ± .054		

Measurements in which slight or no relationship exist as shown by correlation coefficients are initial live weight, width of rear flank, height at shoulder point and the distance of rear flank and chest from the ground.

A close relationship of circumference of chest with height of withers

is indicated by $r = 0.621 \pm 0.034$. Likewise, the width of chest and depth of chest by $r = 0.365 \pm 0.072$ show a definite relationship.

The hind quarters of a steer are more important than the fore quarters in determining the gaining capacity of a steer, with the exception of the circumference of chest as shown by a correlation coefficient of 0.224 ± 0.054 for width of thurls, 0.271 ± 0.053 for distance of hip to buttock and 0.221 ± 0.053 for circumference of rear flank.

The following points (see p. 361), held by authoritative judges of live stock to be important, are not substantiated by the results of this study thus far: Initial weight of steers, closeness to the ground of chest and hind flank, and the length of body from shoulder to buttock. The circumference of chest and rear flank are more important in ascertaining gains than feed capacity as indicated by the circumference of paunch.

323 – Influence of the Degree of Fatness of Cattle upon their Utilization of Feed. – ARMSBY, H. PRENTISS and FRIES J. AUGUST, in the *Journal of Agricultural Research*, Vol. XI, No. 10, pp. 451-472, Tables, 1 fig., bibliography of 8 publications. Washington, December 3, 1917.

It is well known that the gain in live weight per unit of feed diminishes as fattening progresses; it is supposed that the cells of the adipose tissues, as they become loaded with fat offer an increasing resistance to the deposition of added fat, to overcome which increased expenditure of energy is required. Consequently a given amount of food gives a smaller gain in fat in a fat animal than in a thin one as a result of a correspond ing increase in heat production and a reduction in the net energy value o the feed. Mr. ARMSBY, Director of the Institute of Animal Nutrition of the Pennsylvania State College, and the Assistant Director, Mr. FRIES, have investigated this subject by a direct comparison of the metabolism of an animal in ordinary condition and when well fattened.

Rations and periods.

Period	Preliminary period	Digestion period	Daily ration	
			Hay	Concentrats
			kg	kg
Period 1	November 2-12	November 13-22	1.7	3.4
Transition	(December 23 29)	—	—	—
Period 2	November 30-Dec. 10	December 11-20	3.5	7.0
Fattening	(Dec. 22-March 14)	—	—	—
Period 3	March 15-25	March 12-April 4	3.8	7.6
Period 4	April 5-15	April 16-25	2.0	4.0

METHOD. — *Subject:* a pure-bred shorthorn steer about 2 years and 9 months old at the beginning of the experiment. — *Rations and periods:* the animal received a basal ration of alfalfa hay and a mixture of concentrates (1 part of cottonseed meal, 2 parts of wheat bran and 6 of maize meal). This ration was always fed in the same proportions — 2 parts of concentrates to 1 part of alfalfa hay — and supplied throughout the experiment, which

was divided into four parts (see the appended table). During two successive periods the animal received quantities of this feed equivalent to a maintenance ration (period 1), and to a fattening ration (period 2). Fattening was then started, during which the steer gained 300 lbs. The experiment was continued in the reverse order, a fattening ration being first given (period 3), then a maintenance ration (period 4).

RESULTS. — These two successive comparisons of metabolism resulted in much data (grouped in a series of tables in the appendix) which lead to the following conclusions: —

1) *The digestibility* of the heavy ration is smaller than that of the light ration; it does not depend on the degree of fattening as corresponding rations were equally well digested before and after fattening.

2) *Urinary excretion.* — The percentage of nitrogen, carbon and energy lost in the urine was less on the heavy than on the light ration, and a little greater in the fattened than in the unfattened animal.

3) *The production of combustible gases,* both as compared with the total feed and with the digestible carbohydrates was notably less on the heavier than on the lighter ration, both before and after fattening.

4) *Value of the gross energy of the feed.* — In consequence of the smaller losses in urine and in combustible gases this loss was greater on the heavy than on the light ration; no difference in this respect was observed between the fattened and the unfattened animal.

5) *The additional heat* produced by the animal on the heavier rations was eliminated by means of evaporation of water.

6) *Energy expenditure consequent on feed consumption.* — The heat increment resulting from the consumption of a unit of feed was only a little greater in the fattened condition; consequently the *net* energy values of the feed and the percentages of metabolizable energy available for gain were slightly less in the fattened than in the unfattened animal.

7) The maintenance requirement was increased by 37 % after 3 months' fattening during which the live weight was increased by 300 lbs. This 36 % increase in basal katabolism was partly due to the greater body weight to be supported while standing, but the katabolism increases more rapidly than the weight or the body surface.

8) *General conclusion.* — The higher maintenance requirement and lower *fixed* metabolizable energy in the fattened animal are the principal factors responsible for slower gain in weight as fattening progresses.

14 - **Breeders of Purebred Stock in Queensland — Beef and Dairy Cattle.** — *Queensland Agricultural Journal*, Vol. VIII, pp. 247-248. Brisbane, November, 1917.

The Department of Agriculture and Stock of Queensland has published in this issue of the Agricultural Journal a revised list of breeders of purebred cattle, for the purpose of informing those who desire to improve their stock where the best cattle can be obtained in the State.

The Department of Agriculture and Stock takes no responsibility in relation to the entries in the list; but, when inquiries were first made, the condition was imposed that the entries were to be only of stock that had

been duly registered or that were eligible for registration in the different herd books. As the entries received were, in some cases, somewhat too confusing for proper discrimination, it has, therefore, now been decided that only such cattle as have been registered will be included. This list of breeders of pure bred stock in Queensland shows that all the principal breeds of cattle are represented and that they were registered in 15 different Herd Books, i. e., Milking Shorthorn Herd Book of Queensland ; Ayrshire Herd Book of Queensland; Ayrshire Herd Book of Scotland ; Holstein Cattle Club Herd Book ; Holstein-Friesian Herd Book of Australia ; Holstein Friesian Herd Book of Queensland ; Jersey Herd Book of Queensland, Herd Book of the Jersey Cattle Society of Queensland ; Commonwealth Standard Jersey Herd Book ; Illawarra Dairy Cattle Herd Book of Queensland ; Illawarra Herd Book of Queensland ; Illawarra Dairy Cattle Association ; Queensland Shorthorn and Australian Herd Books ; Queensland Shorthorn Herd Book ; Australian Hereford Herd Book ; New Zealand Herd Book.

The total number of purebred males and females owned by these breeders may be discriminated as follows between the different breeds.

	Males	Females
Milking Shorthorns	5	61
Ayrshire	74	371
Holstein-Friesian	22	77
Jersey	35	224
Illawarra	5	48
Shorthorn	27	137
Hereford	114	563

SHEEP 325 – **Machine Sheep-Shearing in New Zealand**. — See No. 340 of this *Review*.

PIGS 326 – **Feeding Pigs on Kitchen Waste.** — PRIME, T. F., in *The Journal of the Board of Agriculture*, Year XXIV, No. 10, pp. 1107-1109. London, January, 1918.

Finding no data on the amount of kitchen waste necessary to produce one pound of pork, the author carried out experiments on this subject. To this end he started in January 1917 to keep pigs on this food and continued during 48 weeks. Three pigs were bought on January 9, two of which were killed on March 5 ; four others were bought on March 10, one being killed on June 7 ; on September 1, five more pigs were bought. Throughout the experiment 6 104 lbs. of food were consumed, and 870 lbs. increase in live weight were obtained, or roughly, 7 lbs. of kitchen waste (potato vegetable and fruit peelings and waste, bits and remains of food) produced 1 lb. increase in live weight. During the whole period the only other food used was 28 lbs. of meal, given during a shortage of waste. The pork obtained was of excellent quality.

SERICULTURE 327 – **New Silkworm Rearing Methods; the Acqua Small Trestle System and the Campbell Shelf System.** — ACQUA, C., Rearing early stage silkworms by means of small trestle with immersed twigs, *Rendiconti dell'Istituto bacologico della R. Scuola Superiore di Agricoltura in Portici*, Vol. II, pp. 3-12, figs. 2 ; CAMPBELL, C., Some new methods for rearing silkworms, *Ibid.*, p. 23-29, figs. 2. Portici, 1917.

For some years, attempts have been made to diffuse the economic method of rearing employed in Friuli throughout Italy. This system consist

in giving the larvae, after the 3rd. or 4th. stage, leaves attached to the boughs, using horizontal hurdles or special trestles as supports. For the first stages, the Friulian system does not differ from these ordinarily used. The author has a system, by means of which the larvae can be reared on boughs from hatching. To preserve the leaves fresh and tender, and to avoid loss due to the rapid withering of the cut leaf, the lower ends of the branches are kept immersed in a small basin of water, placed on a shelf attached to the lower part of each side of a small trestle, some 20 in. × 20 in. square, (fig. 1). A metal sheet is spread over the trestle, and covered with cardboard, strong paper, or even gauze. The small basin is provided with a stoppered opening, so that the water can be changed without moving the recipient. When the leaves are eaten, fresh boughs are placed with their ends in the water (which has been changed), care being taken to place them close to the old boughs ; the young silkworms soon pass on to the fresh

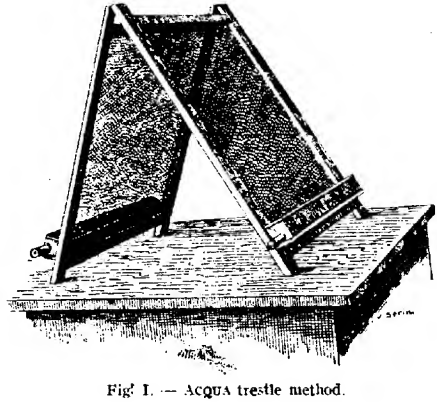


Fig. 1. — ACQUA trestle method.

eaves ; the day after, the old boughs are removed. Four small trestles suffice for rearing 2 ounces (60 gm.) of eggs up to the end of the second stage ; the system may be used for the third stage, by employing larger trestles. Thus, for 2 ounces (60 gm.) of eggs, a trestle, 6 ft. 6 in. × 6. ft. 6 in., would be used, divided in two by a small shelf on which a small basin is placed, as with the lower one. For the 5th. stage, it is useless to place the boughs in water, as the larvae eat the leaves before they have time to wither and losses due to withering are not to be feared. With this system there is economy of labour, a saving of leaves, and better hygiene, due to the suppression of litter.

The small trestle of Prof. ACQUA gave good results in the hands of private rearers, as well as at the Sericultural Institute of Portici.

Prof. CAMPBELL has introduced a slight modification into the system. The trestle devised by him is about 3ft. long and 1ft. 6 in. high ; on the frame

is stretched a cloth which remains till the end of the season, when it is washed and replaced. At the foot of the trestle is the shelf on which is

Fig. II. — CAMPBELL shelf method.

placed the basin, above which is a board perforated with holes to receive the ends of the mulberry branches ; with this device there is no fear of the larvae falling in the water and drowning, while the water is also protected

rom dust. Prof. CAMPBELL is of the opinion that this system should be- ome widely used, especially in southern Italy, where the high temperature nd dry climate soon cause the leaves to wither and lose their freshness.

To restrict the space required so as to approximate that necessitated y the Friulian system, Prof. CAMPBELL has devised a system for rearing tages following the first one, and which consists of hurdles or supports (fig. 2) placed one above the other in pairs, 6ft. 6 in long and 3ft. 3 in. apart; the double series together thus being 6ft. 6 high. On each support are small shelves, each 2ft. wide and inclined inwards; the boughs are placed upright on these shelves, their tops being supported obliquely by transverse ledges.

The mulberry branches are placed successively on the shelves according to the development of the larvae, and the length of the branches available. In the 4th. and 5th. stages the branches can be placed up to the third shelves in measure as the branches are gradually stripped. The branches are first placed in one half of the trestle, and when this is quite full and the larvae have eaten all the leaves, the branches are placed in the opposite half well in contact and interlaced with the branches on which are the larvae, o that they can easily pass on to the fresh boughs.

As an alternative, both sides of the trestle may be used by slightly separating the branches on which are the larvae, and placing the fresh branches in the gaps between, when the first are completely eaten. The old branches are removed when the larvae have left them.

The oblique shelves prevent the larvae from falling to the ground or on the lower shelves, and also receive the excreta. At the end of the 5th. stages, the heath is placed in the upper half of the trestle and the larvae move into it of their own accord.

This system gives economy of space and labour, as well as better hygienic conditions due to the good ventilation.

8 - **On Some Cytological Data on the Phenomena of Parthenogenesis in the Silkworm** (1). — LECAILLON, A., in *Comptes rendus des Séances de l'Académie des Sciences* Vol. 166, No. 4, pp. 180-181. Paris, Jan. 28, 1918.

The author gives the results of his investigations into certain ndamental points concerning the changes which taken place in the ıfertilised egg.

1) The examination of consecutive sections of eggs which, towards ıe third day after being laid, began to turn from yellow to pink, showed that ıe development of the embryo had already reached the stage where the ırum, amnios and embryonic sack were formed. and where the breaking p of the vitellus has already taken place. The stage at which colour begins) change is not a starting stage, but corresponds to an already advanced evelopment. The appearance of the pink colour is due to the deposition f pigmented granules in the cells of the serous envelope against the vitelne membrane. This stage is exactly similar in the fertilised egg.

(1) See *R.* April, 1916, No. 427; Oct. 1917, No. 936; Nov., 1917, No. 1050; Feb., 1918, o. 197.

2) In unfertilised eggs which have not changed colour and have been laid a sufficiently short time for the cellular degeneration to be still visible, an intravitelline segmention was observed similar to that taking place in the fertilised eggs of most insects, except that more or less premature cessation of development was manifest.

3) In unfertilised eggs which had kept their original yellow colour, but which were from 10 to 12 days old, cellular degeneration was much more marked than in the preceding case.

4) These facts confirm and extend those already given by the author in a preceding note (1), which showed that, in the eggs of *Bombyx mori* which do not change colour, important phenomena of development take place. The capacity for parthenogenesis in the silkworm, therefore, really corresponds to a quality proper to the female reproducing element and not to a property peculiar to eggs which change colour after being laid.

The earliest stages of degeneration observed in *Bombyx mori* which only correspond to a segmentation stopped very early seem in every way comparable to the rudiments of development observed in birds.

FARM ENGINEERING.

329 – **The Work of a Tractor in Stony Soil.** — PLUCHET, E., in *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. III, No. 36, pp. 1037-1040. Paris, November 21, 1917.

The author advised the purchase of a 10-20 HP. tractor for a large estate at Eure-et-Loire, France, having a number of stony areas. The tractor was chosen, on the recommendation of M. RINGELMANN, from amongst those tested at Noisy-le-Grand (2).

Paraffin was used as fuel, being so much cheaper than petrol; heavy oils of at least 39° Baumé could also have been used. The tractor began work on uncultivated ground about July 15, 1917. For various reasons, such as bad weather, harvest work, holidays, etc., the tractor only worked 340 hours, or 45 days of 8 hours, from the above mentioned date up till the end of October. During this time 160.6 acres were worked to a depth of 7 to 8 inches (about 1 acre in 2.2 hours), in very stubborn and stony soil. In these soils, the usual implements and tools wear very quickly and the average work done by 1 man with 3 horses does not exceed 4200 to 4800 sq. yds. per day.

The 160.6 acres worked cost about £ 110. 3s. for fuel, lubricants, socks and new parts, repairs and upkeep. The working parts of the machine did not seem to have suffered, in spite of the difficult ground. The tractor was driven by the estate foremen; in spite of this, the author allowed the drivers the pay of 9½*d.* an hour; on adding, for the working hours £ 13. 12s. to the expenses, the total became £ 123. 15s. and each acre worked cost 15s. 5*d.*

(1) See *R.* Oct., 1917, No. 936. — (2) See *R.*, November, 1917, No. 1051 and *R.* January 1918, No. 81. (*Ed.*)

The author has only been able to estimate very roughly the depreciation of the machine, etc. Supposing that the tractor, which cost £500, can last three years if well cared for, the depreciation would amount to about £13.18s. a month, giving say £48 13s. for the 3 ½ months of work. The total cost for the 160.6 acres would then amount to £ 172. 8s, or. 21s. per acre, which is very high for work at 7 to 8 inches deep, but little higher than the cost for the same work performed by animals.

This example again shows the advantage of machine cultivation and the great help it may afford under the present circumstances, even with imperfect machinery.

330 – **Cultivation Trials with a Moline Tractor, in Italy.** — TARCHETTI, A., in *Il Giornale di Risicoltura*, Year VII, No. 22, pp. 278-282. Vercelli, November 30, 1917.

Cultivation trials with the combined Moline tractor (1) were carried out in ricefields, in October and November 1917, by the Machinery Section of the Experimental Rice-growing Station at Vercelli.

The first trials took place at Muleggio (Vercelli) in both ricefields and ordinary ones. The tractor drew a 2-furrow 12 in. plough, to which was fixed, according to the ricegrowers' wishes, an ordinary coulter as well as a skim coulter replacing the circular coulter.

The wheels were provided with 3 rows of cuneiform spikes projecting 4 in. beyond the tyre. In the ricefield the average speed when working at 6 to 7 in. was about 3 miles per hour ; in the ordinary field the speed was 2 ½ miles per hour at a depth of 7 to 8 in. and a width of 24 in., which correspond respectively to 3 468 and 2 870 sq. yds. of surface covered per hour. These first trials gave quite satisfactory results.

The next trials were carried out at Castelmerlino (Vercelli) in a well-manured riceland, in good general condition, save one short and difficult strip which was very soft. Instead of spikes, the wheels were fitted with strakes projecting some 5 ins. The author gives the following results obtained one period of the trial: —

Duration of trial: 2 hrs., 4 mins., 20 secs., *i.e.*	7460	seconds
Divided up as follows: —		
Duration of ploughing (average of 3 minutes per furrow of 618 ft.	3960	»
Duration of turning (average of 30 secs.) by towing	660	»
Total duration of the work.	4620	»
Optional stoppages for adjustments of plough, measuring, etc..	2840	»
Total time.	7460	»
Average depth of ploughing	7 to 8 in.	
Area ploughed: — average furrow length	618 ft.	
Total furrow width	50.15 ft.	
Area ploughed during the trial	2994.2 sq. yds.	
Petrol consumed during the trial 2.42 galls. equal to 16.94 lbs. (density 700)		

(1) See *R.* 1917, No. 941. (*Ed.*)

The conclusions are:

Petrol consumed (1)	per acre	14.3 lb.
	» hour.	8.16 lbs.
Area ploughed per hour		2762 sq. yds.

Using these results, the author calculates the cost of mechanical ploughing per day: —

The MOLINE tractor with a 2-furrow plough and accessories costs £ 600 in Italy; assuming that the petrol costs 7*d.* a lb. and that a tractor is used on 80 days during the year, the daily cost would be:

Petrol for 10 hours work 88 lbs. at 7*d.* a lb.	51*s.* 4*d.*
Driver's wages	8*s.*
Lubricating oil	3*s.* 2*d.*
Interest and depreciation at 5% on £600 and assuming the machine to last 10 years. — say	20*s.*
Insurance, various expenses	6*s.* 4*d.*
Daily cost	88*s.* 10*d.*
that is, one acre costs 14*s.* 9*d.*	

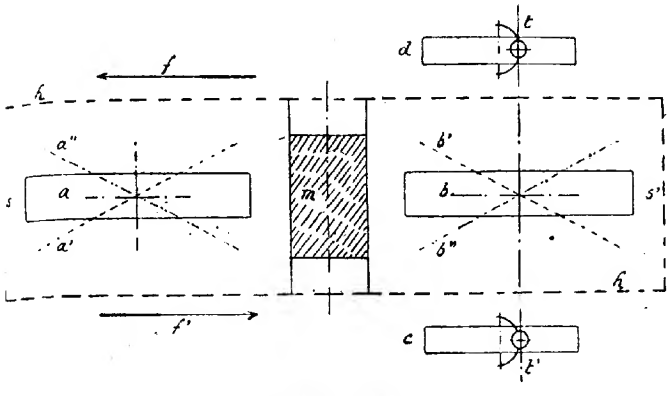
The author observes that machine ploughing is fairly costly but under present conditions, given the scarcity of labour and draught animals, it is important to produce as much as possible.

331 - **The Dessaules Tractor.** — RINGELMANN, MAX, in the *Bulletin de la Société d'Encouragement pour l'Industrie Nationale*, Year CXVI, Vol. CXXVIII, No. 6, pp. 476—478, fig. 1. Paris, November-December, 1917.

The DESSAULES tractor took part in the 1917 trials at Noisy-le-Grand (2), France; the test model was made by M. H. DESPLAND, of Levallois-Perret, Seine. The appended schematic figure shows the type of machine, which has 2 driving and steering wheels *a* and *b*, which can turn obliquely in the directions *a'* and *b'* or *a''* and *b''*; these wheels are placed one behind the other, transverse equilibrium being provided for by two pivoting wheels *c* and *d*, mounted on forks, fixed to a beam *tt'* attached to the upper part of the frame, whose plan is shown at *h*. The engine *m*, placed low down between the driving wheels, chain-drives an intermediary shaft just above it; the shaft drives, through 2 chains, two axles placed above the wheels *a* and *b*; the driving-wheels are driven by 2 chains-drives from these axles; the gearing thus includes 5 chains, which should not run at the same speed as in the experimental model. The driver's seat being placed either at *s* or *s'*, the machine can move either in the direction *f* or *f'* in a turnip-field, without turning on the furrow; the hauling attachment is at *h*, on *s* or *s'*.

(1) The petrol consumption on normal work would be 8.8 lb. per hour and 16 lb. per acre. (*Author*)

(2) See *R.* January, 1918 No. 81. (*Ed.*)



Plan of DESSAULES tractor.

332 - **The Wyles Motor Plough.** — I. *The Agricultural News*, Vol. XVI, No. 406, p. 357. Barbadoes, November 17, 1917. — II. FREMIER, VICTOR, in *Le Génie Rural*, Year X, No. 76, (New Series, No. 16), pp. 11-15, figs. 5. Paris, 1917.

According to information received by *The Agricultural News* from the Secretary of the Food Production Department of the Board of Agriculture and Fisheries, England, it would appear that the WYLES motorplough is well suited for work in orchards and on small farms, while being unsuitable for large farms.

This English-made motorplough is guided by handles by a man walking behind ; the 2-furrow plough can be lifted so as to clear the headlands, as the weight of the machine is well balanced about the front axle.

All parts of the machine are standardised and can easily be replaced.

The chief points of the WYLES motorplough are as follows :

1 cylinder vertical 11 HP engine.

Gears completely enclosed and working in an oil bath ; 2 forward speeds are provided ; a reverse is unnecessary.

Wheels — diameter, 2 ft. 9 in. ; tyre, 7 in. wide ; length, 12 ft. 6 in. ; width, 2 ft. 9 in ; height, 4 ft.

Including a 2-furrow plough, it weighs about 20 cwt.

This motorplough, though possibly not very suitable for strong sugar-cane fields, would work very well in light soils, and in cotton fields, etc. It is made by the WYLES MOTOR PLOUGHS Co. Ltd., of Manchester.

II. — The WYLES patent, No. 464 699 (1913), described in *Le Génie Rural*, includes a new device for the steering and general control of wheeled agricultural machinery, such as motorploughs, etc. The cultivating implement may be varied as required. The machine is easily steered and becomes quite automatic (provided that the engine has a regulating device) ; it requires no attention save in turning at the headlands.

Another WYLES patent, No. 477 074 (1914), concerns improvements of a mechanism regulating the wheels which uses the power of the engine, driving the carrying wheel or wheels, to lift the body of the machine automatically.

Designs are given with the patents, showing details of the inventions.

333 – **The Blanchard (1) Double Brabant Windlass Plough.** — RINGELMANN, MAX, in the *Bulletin de la Société d'Encouragement pour l'Industrie Nationale*, Year CXVI, Vol. CXXVIII, No. 6, pp. 473-476, 4 fig. Paris, November-December, 1917.

The BLANCHARD double-brabant plough is of the windlass-plough type; it carries the engine and 2 reeling drums, on each of which is rolled a cable whose end is anchored in the forrow.

An Ardennes farmer, M. BLANCHARD has invented the machine, the model tried at Noisy-le-Grand, France, having been made by M. E. ALLONGÉ of Paris. Figure 1 shows the general view of the machine, while figure 2 shows its plan. In the latter various details can be seen: – the machinery fixed to the support of a double-brabant plough; the beam *a*; the ploughs *b* and *b'*; the furrow wheel *c* running in the furrow *x*, and the land-wheel *c'* running at *x'*; the grounding screw *d* and the stilts *e* that carry the locking mechanism; the stays turning round the beam *a* fixed to the support *ee'*.

The machinery fixed to 2 bars of the wheels *cc'* includes a small 3-4 HP single-cylinder engine *A*; the cooling of the cylinder ribs is provided for by a lateral fan; the petrol tank is placed on a shelf supported at *f*. The engine shaft is connected by a chain drive *g* to an intermediary shaft *B*; the windlasses C are mounted on a shaft driven by a chain *i* from *B*; in these 2 drives, reducing the engine-speed, the tension of the chains are regulated by rollers *h* and *j*. The 2 windlasses C can each be geared up to the shaft on which they are mounted when they pull the plough by rolling up the cable *m*, or put out of gear when the cable *n* is unrolled behind on the untouched strip *x'*. In the machine tested by the author, the cables, when used for traction, pass between guide rollers *l*, which will be replaced in the final model by an automatic winder.

In the trials, the greatest traction could not be more than 770 lbs, equal to the breaking point of the cable. When the plough moves in the direction *r*, it hauls on the cable *m* and pays out the return cable *n* behind. When at the end of the cable, the driver puts the windlass out of gear, removes the cable *m* from the guides *l*, tips and turns the plough so as to place it in position to open the new furrow, fixes the hook of the cable *m* on the anchor chain in the furrow; he then passes the cable *n* between the guide *l* of the second windlass, which he puts in gear, when the plough moves in the opposite direction to *r* to the other headland, when the same process is repeated. The driver walks alongside the machine.

The cables are simply laid down, and are not damaged in any way by rubbing. The anchorage for each cable consists of a chain some 16 ft long,

(1) See *R.* January, 1918, No. 81 (*Ed.*)

held down by stakes ; the cable hook engages in one of the links of the chain, and, each time the plough arrives at the headland, the hook is moved along the anchor chain to a width equal to about twice the furrow width.

BLANCHARD *Double brabant windlass plough.*

Fig. I — View of the machine.

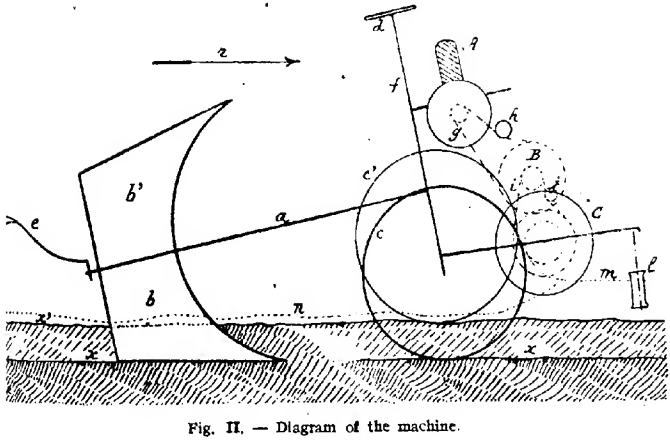


Fig. II. — Diagram of the machine.

334 - **The Shubert Weed and Sprout Destroyer.** — *Farm Implement News*, Vol. XXXVIII, No. 49, pp. 36, 2 figs. Chicago, December 6, 1917.

The extermination of weeds, sprouts, etc., with the usual machines used

The Shubert Weed and Plant Destroyer.

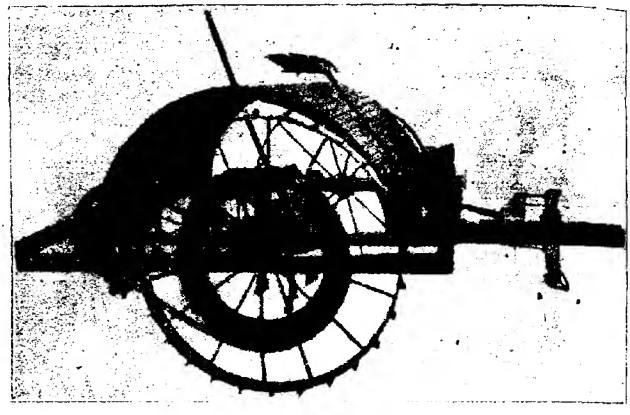


Fig. I. — Side view.

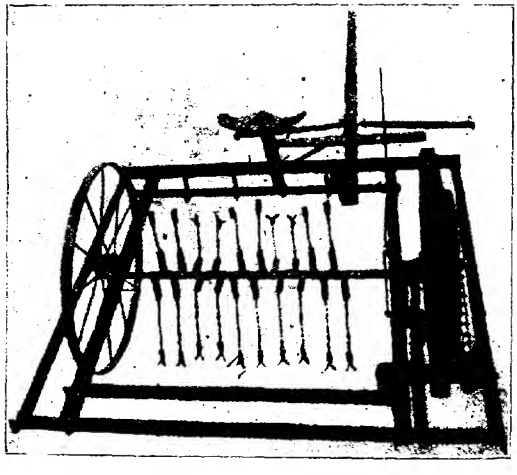


Fig. II. — Rear view.

for that purpose is very difficult and even impossible on stony and stumpy land.

As is shown in the appended figures, the machine is provided with a revolving cross bar to which are attached a number of chains ending in cutting blocks. Power for revolving the chains is derived from one wheel and transmitted by suitable gearing. The chains are whirled at high speed, the velocity being such that any plant struck is reduced to shreds and spread over the ground. Ability to work among stumps and stones is due to the flexibility obtained by using chains, which simply work themselves round obstructions. The cutting ends do not reach the ground, so that grass is left uninjured.

The machine weighs about 850 lbs.; the wheels are about 4 ft. high and the space within the angle iron frame about 4 ft. square. It is made by the SHUBERT SPROUT MOWER COMPANY of Richland Mo., U. S. A.

335 - **Copra Driers.** — See No. 346 of this *Review*.

336 - **Investigations of Irrigation Pumping Plants, in Montana, U. S. A.** — MURDOCK, H. E., in: I. *University of Montana, Agricultural Experiment Station, Circular* No. 6, pp. 37, fig. 17. Bozeman, Montana, January, 1917; II. *Ibid., Bulletin* No. 115, pp. 127—148, fig. 6, tables 5. Bozeman, Montana, January, 1917.

I. In the United States many irrigation pumping plants have been installed without sufficient forethought and thus have resulted in failure.

In studying the question of installing an irrigation pumping plant, special attention should be paid to well prepared plans, proper types of pumps, cost of plant, maximum head that can be lifted, market conditions and prices of crops to be grown, etc. Crops grown with pumped water should require little water and give high crop value for each acre, while the plant installed should give the maximum running economy with the minimum maintenance charges.

The author considers the various types of pumps; centrifugal pumps, the horizontal type of which is most adapted for lifting not more than 30 ft., while the vertical type is suited for deeper wells of 3 to 6 ft. diameter; turbine pumps, for deep wells (250 ft.) of small bore (12 to 30 in.); plunger pumps, for deep wells of small bore (3 in.). It should be noted that irrigation from deep wells is very dear, and only pays for high-priced crops. Plunger pumps are of very small capacity thus being most suited to filling reservoirs till enough water is stored for a day's irrigation.

Irrigation pumps can be driven by windmills, steam, gasoline and oil engines of the portable, stationary and tractor types. Windmills have long been used for this purpose; if well cared for, they last a long time; they usually drive plunger pumps. Using gasoline for pumping is expensive, and to utilise the cheaper, heavy oils the fuel oil engine has been rapidly perfected. The heavy oil engines have the advantage that with a little adjustment they can use any liquid fuel of a higher grade than that for which they are designed. The operation of a steam engine requires a more skilled mechanic than does an internal combustion machine. The laws of Montana require a licensed engineer to operate a steam engine. There is a

large amount of lignite and soft coal in Montana will could furnish a source of cheap power. Electric motors have many advantages; many plants only require a visit once every 24 hours for oiling and other attention.

Curves are given to help in choosing a pump, use being made of various conditions of speed, head, discharge and power. A few of the most common engine and pump troubles are described as well as methods for remedying them.

As regards the cost of operating pumping plants, the author assumes it as being directly proportional to the lift. For a pumping installation driven by a gasoline motor, the proportional annual cost for the gasoline was 58.7 %, 19.7 % for the irrigator and operator, 15.7 % for interest and depreciation, 5.9 % for lubricating oil; for a plant driven by a parafin motor the figures were: — 46 % for paraffin, 25.8 % for the irrigator and operator, 20.5 % for interest and depreciation, 7.7 % for lubricating oil; these figures vary very greatly, but can be much reduced by giving as much care to the irrigation as to the pumping plant.

II. The Agricultural Experiment Station of the University of Montana has tested a number of pumps and engines, in order to throw light on the problems of pumping for irrigation. The tests were partly carried out in the University laboratory and partly with plants actually working.

The pumps tested in the laboratory were: CASE plunger pump; FRIEND motor pump GOULDS Pyramid plunger pump; BYRON JACKSON vertical centrifugal pump; American 7-in vertical centrifugal pump. The pumps tested in the field were all of the horizontal centrifug type and were: 1 Morris 18-in.; 1 American 10-in.; 1 GOULDS 8-in., 1 Rumsey 6-in. and 2 Goulds 6-in. pumps.

The following engines were used in the laboratory tests: — Case 75 HP. steam tractor International Harvester Company 45 HP. petrol-paraffin tractor; Case 36 HP. steam roller; Fairbanks-Morse 5 HP. vertical petrol engine; International Harvester Company 5 HP vertical petrol engine; Friend horizontal 4 HP. petrol engine; Int. H. C. I HP, paraffin-engine Fuller & Johnson 3/4 HP. vertical petrol engine.

The following engines were used in the field: Case 75 HP. stationary steam engine; Fairbanks-Morse 65 HP. stationary steam engine; Fairbanks-Morse 20 HP. horizontal paraffin engine; Galloway 15 HP. horizontal petrol engine; Field 12 HP. horizontal petrol engine; Galloway 8 HP. horizontal petrol engine.

To measure the water discharged, a 2-ft. CIPOLLETTI weir was used For the field tests a temporary rectangular weir was used when practicable for smaller currents a current meter was used. In tests for power consumption a PRONY brake was used.

The results of the tests are shown in 5 tables which give: the HP. of the engines, the head of water, discharge, the various types of pump tested the water lift, consumption of fuel, and the quantity of lubricating oil used

The results of the laboratory tests bring out forcibly the inadvisability of using any chance combination of power and pump that may be available They also indicate what kind of combination should be made to secure an efficient plant. Thus if a 45HP tractor is used to drive a 7-in. vertical pump, with a 50-ft lift, the tests show a fuel consumption of about 0.4 gallon per foot acre-foot, which is very satisfactory. The same tractor driving a 5-in. vertical pump consumes 50 % more fuel; with a 3-in. pump there is

, fuel consumption of about 2.5 times the amount required for the largest ›ump. If the lift is 25 ft., a larger pump than those tested should be used vith such a tractor, for the fuel consumption would be about 50 % greater than that for the 50-ft. lift.

To lift 10 feet, the tractor with the largest pump consumed 1.22 gallons of fuel per acre-foot. With a much larger pump designed for a low lift, ess fuel would have been consumed. In tests with a 5HP. engine, driving a 3-in. and 5-in. pump respectively, the fuel consumption was about).7 gallon per foot acre-foot.

These results indicate the necessity for careful designing of pumping ›lants and proper operation of the plant after it is installed.

337 – **Review of Patents.**

Tillage Machines and Implements.

France	485 428	Plough.
Switzerland	76 642	Tilling machine.
United Kingdom	110 729	Motor-cultivator.
	111 264	Motorplough.
United States	1 246 388	Cylinder harrow.
	1 246 462	Centre pressure device for disk harrow.
	1 246 851	Plough.
	1 246 916	Harrow tooth holder.
	1 247 018 — 1 248 517 — 1 249 178	Stalk cutters for maize.
	1 247 013 — 1 249 450	Harrows.
	1 247 170	Motorplough tractor.
	1 247 762	Tool shifting mechanism for agricultural implements.
	1 248 034	Agricultural implement.
	1 248 194	Cultivator.
	1 248 257	Revolving harrow.
	1 248 945	Land roller.
	1 249 103	Attachment for stalk cutter.
	1 249 395	Self cleaning harrow.
	1 249 447	Tractor plough.
	1 249 523	Two-way motorplough.
	1 249 524	Reversible tractor plough.
	1 249 555	Combined harrow and cleaner.
	1 250 013	Gang plough.

Irrigation.

British India	3 201	Gravity water elevator.
Canada	179 444	Ditch plough.
United States	1 248 271	Regulator plough.

Manures and Manure Distributors.

France	485 455	Ammonia produced by catalysis for making simple and complete manures.
United Kingdom	111 254	Method of treating the soil to improve its productivity by means of spraying water heated at 180-210° F.
United States	1 247 001	Attachment for lime spreader.
	1 247 631 — 1 247703	Manure spreaders.

1 247 632 Wide spread attachment for manure spreader.
1 248 032 Spreader for fertilizer distributor.
1 248 303 Straw spreader.

Drills and Seeding Machines.

Denmark 22 475 Potato planter.
United States 1 247 007 Anchor for check row planters.
1 247 075 Clutch for maize planter.
1 247 738 Planting mechanism.
1 247 744 Combined disk lister and planter.
1 247 763 — 1 248 351 Seed planters.
1 248 717 Maize planter.
1 249 067 Lister plough.

Various Cultural Operations.

United States 1 246 896 — 1 247 764 Cultivators.
1 247 246 — 1 248 160 Cotton choppers.
1 248 010 — 1 249 569 Weeding ploughs.
1 248 231 Riding cultivator.
1 248 365 Machine for pulling cotton plants.
1 248 706 Vineyard disk plough or cultivator.
1 248 914 Hand cultivator.

Control of Diseases and Pests of Plants.

France 185 274 Improvements in powdering machines.
Switzerland 76 646 Trap for rats, mice
United Kingdom 111 044 Device for destroying insects.
111 142 Vermin proof room for preserving fruits.
United States 1 248 751 Grass and weed cutter.
1 249 988 Potato bug killer.

Reapers, Mowers and Harvesting Machines.

British India 3 171 Improvements in or relating to instruments for tapping India rubber producing and like latex yielding plants.
Canada 179 060 Sheaf carrier.
179 090 Grain binder.
179 277 Sheaf shocker.
179 297 Harvester mechanism.
Switzerland 76 644 Cherry picker.
United Kingdom 111 052 Reaping and mowing machine.
United States 1 246 234 Gang lawn mower.
1 246 951 — 1 246 963 — 1 247 005 — 1 247 943 — 1 249 935 Shocking machines.
1 247 070 — 1 249 914 Harvesters.
1 247 387 Cotton picking machine.
1 248 591 Corn husking machine.
1 249 295 Seed gathering attachment for mowers.
1 249 445 Peanut harvester.

Machines for Lifting Root Crops.

Denmark 22 464 Tool for topping and lifting turnips by hand.
22 560 Combined potato digger and elevator.
22 616 Turnip topping and lifting machine

ited States 1 246 811 Beet harvester.
1 247 813 Potato digger.
1 248 330 Beet topping machine.
1 248 379 Beet digger.
1 249 911 Frame for beet harvesting machine.

Threshing and Winnowing Machines.

ada 179 093 Grain cleaner.
179 105 Grain grader and cleaner.
ited States 1 246 949 Grain saving device for threshing machines.
1 249 663 Feeder for grain separators.
1 249 966 Grain separator.

Machines and Implements for the Preparation and Storage of Grain, Fodder, etc.

itish India 3 178 Rice huller.
nmark 22 476 Straw binder.
22 568 Combined straw gatherer and binder.
ited Kingdom 110 556 — 111 307 Baling presses.
ited States 1 246 569 — 1 246 759 — 1 248 753 — 1 249 505 Hay presses.
1 246 994 Stacker.
1 247 233 Hay gathering and baling machine.

Steering and Traction of Agricultural Machinery.

nada 179 228 Wagon mechanism.
ited Kingdom 111 242 Caterpillar tractor.
ited States 1 246 443 Tractor wheel.
1 246 603 — 1 249 996 Tractors.
1 246 777 Whiffle tree.
1 247 073 Traction machine.
1 248 036 Tong truck.
1 248 599 Steering device for tractors.
1 248 693 — 1 249 059 Farm tractors.
1 249 166 Caterpillar tractor track.
1 249 424 Draft connection for tractor.

Feeding and Housing of Livestock.

ted Kingdom 110 853 — 111 214 Horse shoes.
ited States 1 246 751 Collapsible hog feeder.

Poultry Farming.

itzerland 76 645 Transportable poultry house.
ited Kingdom 111 208 Incubator.

Bee Keeping.

ited Kingdom 110 834 Device for uncapping honey combs.

Industries Depending on Plant Products.

itish India 3 130 Improved method for preparing potato meal.
3 133 Improved sugar cane grinding mill.
itzerland 76 680 Grinding machine and plates.
76 892 Fruit and vegetable dividing machine.

Dairying.

Canada	179 217	Cream separator for milk bottles.
	179 270	Bearing for milk separators.
Denmark	22 488	Apparatus for warming or cooling milk by regeneration.
	22 625	Driving mechanism for milk pasteurising apparatus.
Switzerland	76 936	Churn.
United Kingdom	110 621	Cheese (curdling of milk).
	111 341	Process for preparing milk powder.
United States	1 246 292	Teat cup for milking machine.
	1 249 345	Milking machine.

Farm Buildings and Equipment.

United States	1 246 281	Silo.

Various.

British India	3 207	Single or double suction foot pump.
United Kingdom	110 641	Centrifugal pump.
	110 851	Wind motor.

RURAL ECONOMICS.

338 – **Size of Farm Business.** — JOHNSON, O. R. and FOARD, W. E., in *University of Missouri College of Agriculture, Agricultural Experiment Station Bulletin* No. 140, pp. 1-40. Columbia, Missouri, April, 1917.

This study of the size of farm business was made by means of a Farm Management Survey in the Western part of Johnson County, Missouri.

The farm management method of securing data includes the obtaining of estimates of all receipts and expenses on each farm in a district or region, for a year, and the investment at the beginning and close of the year. Data are secured concerning methods, practices and social conditions of the region. The incomes of all farms are then ascertained and certain factors which have to do with the success of the business are calculated. Then the farms are grouped according to size, capital, labour income and other factors.

The Region Studied. — The region selected for this study which includes four townships in the western part of Johnson County, is typical of a large section of the State. The soil, climate, railways, roads, markets, land values, size of farm, and type of farming are similar to those found in many sections of central Missouri. The average crop yields for the region in 1912 were: maize, 35.4 bushels per acre; wheat, 17.8; oats, 28; hay, 1 ton. The average price of maize, was 45 cents, wheat 85 cents, oats 35 cents and hay $ 12.

Size of farms, their percentage distribution and proportion of tillable land. — The farms used were first divided according to number of acres operated, the percentage of tillable and pasture land, and of waste land as shown in Table I. This gives a general idea of the distribution of the farms in the size groups. The average size of the farms of the region was 137.8 acres

TABLE I. — *Percentage distribution of farms by size and proportion of tillable land.*

Size group — acres	Farms	% of total	Tillable land — %	Pasture land — %	Waste — %
< 40	47	7.0	82.2	26.1	6.6
41- 80	149	22.3	86.9	32.4	5.6
81-120	151	22.6	89.5	31.3	5.0
121-200	191	28.6	86.4	33.5	3.5
201-400	106	15.9	84.5	37.5	3.2
> 400	24	3.6	82.4	47.4	2.7
Total	668	100.0			

The distribution of investment in the various groups is shown in able II. The proportion of investment in real estate increases on the rger farms. Under present conditions the market value of land is radually increasing but the man on the small farm gets less benefit from iis increase in value than the man on a large farm, because a smaller per- ntage of this total capital is invested in real estate.

TABLE II. — *Distribution of Investment on 668 Farms.*

Size group	Farms	Real estate	Machinery	Live stock	Supplies	Cash	Total
< 40	47	76.6 %	3.3 %	16.9 %	2.2 %	1.0 %	100
41- 80	149	78.9	2.5	15.5	2.0	1.1	100
81-120	151	81.8	2.2	13.5	1.7	0,8	100
121-200	191	81.3	2.2	13.7	2.2	0.6	100
201-400	106	83.2	1.9	12.3	1.8	0.8	100
> 400	24	83.6	1.6	11.9	1.7	1.2	100

Table III gives the number of various classes of livestock, horses, cows, rood sows, and total animal units (1), on the farms of different sizes, e crop acres per animal unit and the efficiency with which the farmer uses s own labour and equipment on the various sized farms. The operator a small farm grows 15.9 acres of crops for each workman, 7.3 crop acres r each work horse and 20.9 crop acres for each hundred dollars invested farm machinery. Against this the 201—400 acre farmer grows 67 acres crops for each workman, nearly 17 acres for each horse and 35 acres for ch 100 dollars worth of machinery. The workman has multiplied his

(1) DEFINITION OF TERMS. *An Animal unit* is a horse, cow, five mature hogs, or seven ature sheep; two young animals are regarded as equal to one mature animal of the same nd, on the basis of feed and manure produced. This unit is only approximate at best.

A productive work unit is a 10 hour day of productive work, done by either a man or horse. It includes work on live stock, on farm crops, or on the improvement of land; t not on work stock, on the repairs of fences, buildings, and machinery; or on anything e included in the maintenance of the farm.

A crop index of 97 simply means that the yield per acre of all crops on this farm or group farms is 97 % as great as the average yield of the groups of the region.

Labour income is the farmer's net return after paying from his gross income all general nning expenses, including also interest at 5 per cent, depreciation, and wages for hired labour d members of his family, but excluding household expenses. (*Ed.*)

efforts by four, the work horse has doubled the amount of work which he does, and the cost of using equipment has been reduced by nearly half. This will explain in part some of the results which will be given later.

TABLE III. — *Animal Units, Labour Equipment and Size of Farms.*

Size group	Horses	Cows	Sows	Total animal units	Crop acres per animal unit	Crop acres per animal unit except horses	Average size acres	Crop acres per Man	Crop acres per Horse	Crop acres per $100 equipment
< 40	2.3	2.8	1.0	4.8	3.48	6.68	26.6	15.9	7.3	20.0
41–80	3.5	2.4	1.8	10.6	3.29	4.13	64.6	25.9	8.4	22.0
81–120	4.2	3.0	3.8	13.4	4.47	6.52	103.3	49.2	14.3	33.0
121–200	5.8	4.6	3.1	21.0	4.20	5.81	159.2	58.9	15.3	33.1
201–400	8.0	6.6	5.7	31.8	4.25	5.68	243.5	67.7	16.9	35.1
> 400	10.4	14.9	10.5	53.8	3.88	4.84	459.6	77.2	21.2	35.6

The same general condition is shown in Table IV, giving the number of productive work units (1) per man and horse on farms of various sizes. This table shows that the man on the smallest farm does about a third as much work as the man on the farm of the next size, while the horse on the larger farm does one and a half times as much as the horse on the smaller farm. The labour income varies in the same direction.

TABLE IV. — *Productive Work Units and the Size of Farms.*

Size group	Average size acres	Work units per man	Work units per horse	Labour income
< 40	26.6	65.4	32.0	$ 146
41–80	64.6	110.3	31.0	227
81–120	103.3	148.7	43.5	313
121–200	159.2	167.1	44.3	525
201–400	243.5	213.0	48.2	711
> 400	459.6	171.5	48.8	999

In Table V it will be found that the receipts per acre decrease as the farm increases in size up to the 120 acre farms, above that there is practically no variation. The farmer on 64 acres has about as much expense and about the same receipts per acre as the man on the 240 acre farm. This gives them about the same net income per acre. When this net income is multiplied by the number of acres operated, it is understood why the large farmer gets the larger labour income.

In comparing crops yields it is found that except for the 26.6 acre farm the yields gradually increase as the size of farm increases. This is shown in Table VI, the crop index (1) being the average yield of all crops in terms of per cent ; the average yield of four of the more important crops higher on the larger farms.

(1) See notes page 381.

TABLE V. — *Size of farm and Receipts and Expenses per Acre.*

Size of group	Receipts		Expenses		Net income per acre
	per farm	per acre	per farm	per acre	
< 40	$ 463	$ 17.40	$ 195	$ 7.30	$ 10.10
41–80	905	14.00	410	6.30	7.70
81–120	1 177	11.40	465	4.50	6.90
121–200	2 124	13.30	980	6.10	7.20
201–400	3 224	13.30	1 480	6.10	7.20
> 400	6 216	13.60	3 270	7.10	6.50

TABLE VI. — *Crop Yields and Size of Farms*

Size of group	Farms	Average size acres	Labour income $	Crop index %	Corn, bushels per acre	Wheat, bushels per acre	Oats, bushels per acre	Hay, tons per acre
< 40	47	26.6	146	100.74	32.8	16.9	0.0	1. 2
40–80	149	64.7	227	92. 3	31.9	18.2	25.4	1.15
81–120	151	103.3	313	93. 9	34.1	16.2	25.7	0.98
121–200	191	159.2	525	101. 2	36.3	16.5	25.8	1.14
201–400	106	243.5	711	102. 5	36.8	17.5	31.6	1.05
> 400	24	459.6	999	110. 4	38.0	21.9	34.9	1.06

TABLE VII. — *Income and Size of Farms.*

	< 40 acres $	41–80 acres $	81–120 acres $	121–200 acres $	201–400 acres $	> 400 acres $
Capital:						
Land	1 872	4 230	6 520	10 068	17 192	32 561
Machinery	80	133	176	266	387	586
Livestock	414	830	1 070	1 687	2 525	4 618
Supplies	56	108	130	257	380	682
Cash	25	61	68	112	175	491
Total capital	2 247	5 362	7 682	12 390	20 659	38 939
Receipts						
Crops	51	118	188	357	680	1 289
Stock	132	306	390	870	1 214	3 161
Stock products	60	103	122	181	183	161
Miscellaneous	119	149	164	296	413	490
Increased inventory	101	229	313	420	734	1 115
Total receipts	463	905	1 177	2 124	3 224	6 216
Expense						
General	131	282	331	623	1 040	1 781
Stock	45	80	92	277	376	1 337
Decreased inventory	19	48	34	80	64	152
Total expense	195	410	465	980	1 480	3 270
Farm income	268	495	712	1 144	1 741	2 946
Interest on investment	122	268	399	619	1 033	1 947
Labour income	146	227	313	525	711	999

The results shown in the foregoing tables must lead to the conclusion wn in Table VII, giving the capital, receipts, expenses, and labour income

of the various groups. The farmer on the 26 acre farm has only $ 2447 capital and gets a farm income of $ 268. The farmer on the next group has $ 5362 capital and gets a farm income of $ 495. The farm incomes gradually increase until the larger farm is reached where the farm income is almost $ 3000, giving a labour income of approximately $ 1000.

Table VIII shows in a different way the relative profitableness of labour put in on live stock and also on cash crops, on the various sized farms.

TABLE VIII. - *Returns per Days' Work on Crops and Stock Sold.*

Size of farm	Work done		Crop receipts		Net stock receipts	
	Crops Days	Stock Days	Total $	Per day $	Total $	Per day $
< 40	9.90	99.70	38.90	3.93	140	1.41
41- 80	23.50	159.40	109.80	4.67	323	2.03
81-120	38.27	244.93	171.00	4.49	505	2.06
121-200	65.82	312.18	326.00	4.96	812	2.05
201-400	128.70	458.65	733.00	5.70	1 056	2.30
> 400	177.90	539.70	1 278.00	7.18	3 228	4.13

The table in general shows a gradual increase in wages per day's work from the small to the large one. In preparing this table, all labour on crops sold was charged to crops, and all labour that was put in crops that were fed was charged to the live stock, after the labour of growing crops for work stock and the crops fed work stock was taken out of the total.

In general it shows that the farmer received half the wage in handling live stock that he received for growing cash crops. This does not mean, however, that he should devote all his efforts to growing cash crops, but lends emphasis to the fact that while a cash crop is often more profitable than a crop fed to live stock, when figured in terms of daily wages, yet the live stock enterprises will furnish labour throughout a much greater portion of the year, thus making the total wage at the close of the year much larger. A man is kept busy with his live stock during rainy weather and in winter when cash crops will furnish no labour at all. It can readily be seen from this table, however, that it will probably give him a more desirable system to have some cash crops in combination with live stock enterprises.

Table IX gives the net receipts from crops and stock and their percentage distribution between the various crops and various classes of stock.

TABLE IX.

Size of farm	Farms	Net receipts from		Percentage from crops	Corn	Wheat	Oats	Hay	Cattle	Hogs	Sheep
		Crops	Stock								
		$	$	%	%	%	%	%	%	%	%
< 40	47	82	174	32.0	74.5	25.5	0.0	0.0	31.6	33.6	0.0
41- 80	149	187	393	32.3	39.1	52.4	3.0	5.5	29.0	42.6	3.0
81-120	151	284	561	33.7	31.6	62.0	1.6	4.8	29.0	49.0	2.0
121-200	191	461	912	33.5	17.8	74.8	2.3	5.2	37.3	45.6	2.3
201-400	106	903	1 285	41.3	16.0	77.8	0.6	5.6	32.3	53.0	5.3
> 400	24	1 386	2 610	34.7	8.5	74.0	1.5	16.0	40.2	50.8	3.0

As the size of farm increases, the importance of corn as a money crop decreases and the importance of wheat and hay increases. In general as the size of farm increases the importance of cattle and hogs increases also, but the receipts from hogs increase more rapidly than the returns from cattle. In the first three groups, the returns from cattle are in the form of dairy products almost entirely, while on the larger farms the returns are often in the form of beef, dairy products being of less importance. Considering the social side of the farm business, on various-sized farms, some interesting facts were brought out. The family living on the small farm costs about $62 per person, while on the large farm $104 a person is spent. The large farmer spends more than four times as much for religious purposes as does the small farmer. The relative importance of cash expenses, produce, and other expenses of family living does not differ widely on the small and the large farm. Of the family living expense, 57 per cent. is a cash item; about 40 per cent, is produce furnished by the farm and the remainder is miscellaneous expenses

After this discussion of the farm business measured by the number of acres farmed, the writers turn to the study of the influence of various amounts of capital invested on the labour income in the various groups. The following facts were brought out from this study. The labour income, on a certain sized farm, is limited by the capital investment. Some farms are too heavily capitalized and others do not have enough capital invested. The most successful farms in each group have an investment of from $70 to $95 per acre. The farmer with a low capital investment ($54 per acre) sells more crops (50.3 % of receipts from crops) and gets lower yields (94.3 % crop index) than either of the other classes. The man with too high an investment per acre ($148 per acre) does not sell enough crops (73.3% of receipts from crops), nor are his yields high enough to warrant his excessive investment (106.3 crop index); consequently his labour income is low. The man with a low capital investment per acre, does not keep much livestock and gives most of his time to crops. The man with a high capital investment per acre, is fairly heavily stocked and gives only about half his time to crops. The farmer who is making the best income gives about 60 per cent. of his time and about 94 per cent. of his horses' time to the production of crops.

The man with a low capital investment per acre, is giving so much attention to grain farming that his system does not give him enough productive labour. Where the capital is larger, the farmer is able to keep more livestock and thus secure more regular employment. This influences his labour income to quite an extent.

The work horse works harder on the farm with less capital per acre, but this difference in the amount of work which the horse does, does not offset the other advantages of the diversified or stock farming system, which the man with more capital is able to practice on a given area.

Considering the value of land it was found that the value per acre of land does not vary uniformly with the productivity of the soil. The yields increase as the value per acre increases up to $60 to $80 land. Above this

point the increase in yield in much less rapid than the increase in market value. The labour income reaches its highest point on the $60 to $80 land. After that the income begins to fall.

The profitableness of a certain farm is also influenced by the amount of productive labour done. It is easily possible for a 160-acre farm to support no larger business than an 80-acre farm. A system which furnishes from 2 to 2.3 days productive man labour per acre pays the largest labour income.

The profitableness of a certain-sized farm is also effected by crop yields. The labour income on a farm increases uniformly as the crop yield increases.

339 – **Government Lands, Leased Lands and Alienated Lands in Australia.** – *The Pastoral Review*, Vol. XXVII, No. 12, pp. 1137. Melbourne, December 15, 1917.

According to official returns there were to the end of June, 1916, in Australia, 105 422 000 acres of land belonging to private owners, while a further 56 096 000 acres were in process of being sold by the Government to private owners.

Then there were 893 054 000 acres leased, or held under various forms of tenure, and 849 159 000 acres of vacant Government lands, including road and reserves. The position in each State is as follows: —

	Fully Alienated. Acres	Alienation Proceeding. Acres	Leased. Acres	Unoccupied. Acres
1 New South Wales	40 363 316	19 409 656	118 865 868	19 415 530
2 Victoria	24 256 222	8 075 653	13 035 612	10 878 273
3 Queensland	16 447 382	10 776 793	332 824 905	69 070 920
4 South Australia	10 590 756	2 943 395	115 396 433	114 314 216
5 West Australia	8 125 629	13 584 076	196 772 098	406 106 997
6 Tasmania	5 125 197	1 225 924	1 939 905	8 486 571
7 North Territory	474 590	—	113 926 627	220 715 583
8 Fed. Territory	38 961	80 979	292 690	171 030
Australia	105 422 053	56 096 476	893 054 138	849 159 173

340 – **Machine Sheep-Shearing and Lack of Labour in New Zealand.** — BRUCE, J. L., in *The Journal of Agriculture, New Zealand Department of Agriculture, Industries and Commerce*, Vol. XV, No. 3, pp. 134-135. Wellington, September 20, 1917.

Most of the New Zealand owners of sheep realise the advantages of the mechanical shearer, which permits shearing to be carried out more rapidly and more perfectly. Under present conditions it is becoming more and more difficult to find good shearers, and it is especially the small owners who meet with the greatest difficulties. The problem to be solved is whether it is advantageous for each herd owner to possess a mechanical shearer. The co-operation of small owners for the use of one mechanical shearer, as has been advocated, though perfect in theory, is not easy in practice. Each owner of at least 200 sheep should have his own mechanical shearer. Such an apparatus, with a 1 ½ HP motor costs £ 110 (motor, £ 50, plant £ 60). As the use of a machine allows, at the first shearing a wool surplus which the author estimates at £ 10, and as the value of wool is now 55 % higher than it was in 1913-1914, a yield of from 8 lb. to 9 lb.

would pay half the cost of installing the machinery from the first season. A larger motor, preferably of 4 HP, would be more satisfactory, even for a small herd, for besides shearing, it could also be used for working a chaff-cutter, a pump, etc.

The reduction of labour is of the utmost importance in the present crisis, and in New Zealand, which is essentially agricultural, mechanical shearing is sure to play an important part.

AGRICULTURAL INDUSTRIES.

341 - **The Autolysis of Yeast and the Influence of Its Products of Proteolysis on the Development of Yeast and Lactic Bacteria.** — VANSTEENBERGE, P., in the *Annales de l'Institut Pasteur*, Vol. XXXI, No. 12, pp. 601-630, Tables VII. Paris, December, 1917.

Experiments made by the author at the Microbiological Laboratory of the Higher Technical School of Delft (Holland), using: — 1) pressed beer and distillers' yeast; 2) various lactic ferments. The following results were obtained :—

After the death of the yeast cell, it loses its water, becoming much smaller. When the dead yeast has retained its fermentative, especially its proteolytic, activity, the yeast " liquefies ", after a time varying with the temperature. The optimum temperature for the endotryptase is from 45-50° C. and the maximum at 53° C. The optimum for autolysis of the living yeast tested was from 48-50° C.

The increased acidity to litmus or phenolphthalein up to a certain fixed degree and the crystallisation of the tyrosine may be taken to show the good progress and end of the autolysis.

Yeast water, obtained by boiling fresh yeast in water, only contains 1/3 of the total nitrogen of the yeast. A preliminary autolysis for 23 hours at 48 to 49° C., changes all the nitrogen into soluble nitrogen not coagulable by heat. Autolysed yeast water is a better food for yeast and lactic bacteria than yeast water obtained by simply boiling. Apart from the quantity, the quality of the nitrogen is greatly improved by autolysis.

In autolysed yeast water of the strength of 20 gm. of yeast to 100 cc. of water, there are products that are unfavourable to the growth of the yeast; this harmful influence is removed on dilution.

Amongst substances acting in this way, tyrosine and leucine may be considered as two of the chief products of autolysis.

Leucine is still favourable at the strength of 0.08 gm.%, but completely stops development at 0.66 gm.%. Tyrosine is favourable up to 0.05 %, but beyond that strength is harmful. Asparagine as harmful beyond 1 %.

These products, though harmful to yeast at the strength at which they occur in autolysed yeast water, have no unfavourable influence on the lactic ferments even at the same ength.

The value of autolysed yeast water is due to a mixture of proteolytic products, the chief of which is peptone, and where small quantities of a series of substances, including leucine, asparagine and tyrosine, favour,

independantly of the yeast, the growth of the yeast and of the lactic bacteria.

The value of extract of malt is probably due to the presence of a series of proteolytic products similar to those in autolysed yeast (1).

342 - **The Milling and Baking Qualities of Australian Wheat.** — SCOTT, P. RANKIN and WINSLOW, F. G. B., in *The Journal of the Department of Agriculture of Victoria, Australia*, Vol. XV, Pt. 8, pp. 474-481, 1 diagr., 3 figs. Melbourne, August, 1917.

Wheat growing is one of the most important industries of Australia. New South Wales, South Australia, Western Australia and Victoria produce about 4 ½ times their own requirement in wheat. In order to control the wheat exported each year the Corn Section of the Chambers of Commerce of the four above-mentioned states fixes a standard of quality, called " fair average quality " or " F. A. Q. standard " which is representative of the quality of wheat produced each year. The standards fixed correspond to the quantity available, an average of 135 000 000 bushels, the yield from the separate States being : — Victoria, 50 000 000 bushels, South Australia, 40 000 000 bushels, New South Wales, 31 500 000 bushels, and Western Australia, 13 500 000 bushels (These totals do not include the quantities set aside for sowing and the feeding of poultry). The amount estimated for home consumption is 30 000 000 bushels, leaving, in normal years, 105 000 000 bushels for export, either as grain or as flour.

In order to ascertain the variations in quality due to climatic conditions during the period of growth experiments were carried out : — 1) to determine the amount of impurities and the proportion in which the various ingredients are present ; 2) to classify the wheat according to size and determine the proportion of the various ingredients of each size ; 3) to determine the unit weight per volume of original wheat and cleaned wheat ; 4) the milling capacity ; 5) to determine the gluten content, strength and colour of the flour ; 6) its baking qualities.

The chief results are given in the appended tables. Table I shows that in one year, about 24 000 tons of impurities are exported mixed with the original wheat ; if only cleaned wheat were exported the cost of shipping would be proportionately reduced ; moreover, this quantity could be advantageously used in Australia for feeding cattle. The average percentages of impurities found in the wheats analysed during the four years 1912-13 to 1916-17 were: — New South Wales, 0.52 ; South Australia, 1.03, Western Australia, 0.59 ; Victoria, 1.01.

The measurements of the grain given in Table II are of importance in milling, where large, well-developed grain is preferred, as, the more uniform it is, the better does it mill. For most varieties, the larger the grain, the higher is the yield in flour. This does not always apply to a composite sample, as the bran layer is thicker in some varieties than in others. It would be very advantageous to sift the grain before exporting it, so as to

(1) As regards the use of artificial cultures of yeasts for making forage albumen, see B, November, 1915, No. 1201. (*Ed.*)

remove broken or shrivelled grain, the quantity of which was estimated at 12 408 tons, or 4.35 % of the yield, in 1916-17.

The results of the milling tests, given in Table III, show that the amount of water required to condition the wheat was greater than usual, the duration of the operation rather less. The wheats of South and Western Australia gave a high percentage of flour, those of New South Wales and Victoria, a low one. The colour of the flour of all the states was much below the average. None of these wheats can be considered of first quality as regards gluten content or water absorption capacity.

TABLE I. — *Amount (in grams) of foreign matter and unthreshed heads in Australian Wheat* (1.000 grams taken).

State	Barley	Chaff	Drake	Oats	Rubbish	Smut	Stem	Whiteheads	Wild Oats	Wild Seeds	Per cent.	Unthreshed heads per cent.
New South Wales .	0.48	1.52	0.05	0.56	0.52	0.12	0.07	0.19	0.48	0.14	0.413	2.04
South Australia .	2.41	1.47	2.34	0.36	0.84	0.79	0.38	0.38	0.14	0.14	0.925	0.62
Western Australia	2.67	1.73	1.46	0.31	0.34	0.09	0.06	1.29	0.06	0.04	0.805	0.40
Victoria	1.79	2.98	2.23	1.84	0.48	0.22	0.28	0.61	0.33	0.27	1.103	1.59

TABLE II. — *Amount of grain (in grams retained on sieves of varying mesh* (1000 grams taken).

State	Size of mesh						
	3.25	3.00	2.75	2.50	2.25	2.00	Screenings under 2.00
New South Wales . .	9.5	75.5	122.5	407.0	224.0	107.0	54.0
South Australia . . .	13.5	203.5	280.5	333.0	65.5	14.0	30.0
Western Australia . .	5.0	198.5	325.5	358.5	74.0	17.5	21.0
Victoria.	4.0	162.0	199.0	442.5	118.5	45.5	28.0

TABLE III. — *Results of milling tests of F. A. Q. samples* 1916-1917.

State	Cleaned wheat Bushel weight lbs.	Dirty wheat Bushel weight lbs.	Break flour per cent.	Flour per cent.	Bran per cent.	Pollard per cent	Colour 20 points max.	Strength quart water 200 lbs. flour	Wet gluten per cent.	Dry gluten per cent.	Moisture content Wheat. per cent.	Moisture content Flour per cent.
Victoria.	64.7	60.25	7.5	69.2	17.2	12.6	15.5	17.0	19.25	7.11	11.70	13.06
South Australia .	64.9	62.00	6.4	73.7	16.3	10.0	15.5	47.6	19.66	6.70	11.34	13.07
New South Wales.	60.9	56.75	5.4	68.6	21.0	10.4	14.5	44.3	18.82	7.00	11.53	13.06
Western Australia	67.1	62.75	3.6	74.9	17.4	7.7	17.0	49.9	22.9	8.01	10.38	12.30

The advantages to Australia of exporting flour instead of wheat are pointed out ; they are a saving of ⅓ of the tonnage, the home use of the residue and by-products, the encouragement of the national industry.

343 - **The Soluble Nitrogenous Matter as an Index of the Baking Quality of Flour.** — ROUSSEAU and SIROT, in *Comptes rendus des Séances de l'Académie des Sciences*, Vol. CLXVI, No. 4, pp. 190-192. Paris, January 28, 1918.

In 1913 the authors showed that, to an appreciable extent, it was possible to estimate the baking quality of flour by the ration of the total nitrogen to the nitrogen soluble in water (1). They continued their study with different samples, considering the inverse ratio, which seemed preferable.

I. NORMAL FLOUR. — 1) *Flours of a bolting degree inferior to* 70 %. — The proportion of soluble nitrogen was about 17 % of the total nitrogen with a minimum of 16.1 % and a maximum of 19 %.

2) *Flours bolting over* 70 %. — The proportion of soluble nitrogen decreases as the bolting degree increases; proportions between 16.6 and 18.1 represent the best baking qualities.

3) *American flours.* — Many American flours very rich in gluten have a proportion of soluble nitrogen between 12.5 and 12.8 %. The addition of such flour improves native flours which "relâchent" (2), in which the ratio of soluble nitrogen to total nitrogen is very high ; such addition lowers the ratio, making it almost normal.

II. ABNORMAL FLOUR (giving rise to difficulties in breadmaking). — The proportion of soluble nitrogen is above 20 %, more often about 22 % ; it even rose to 62.5 % in a flour which had been stored a long time.

III. VARIOUS FLOURS. — The values found for the ratio soluble nitrogen : total nitrogen were : — maize, 18.1 and 18.5 ; rye, 22.7, 22.2 and 22.7 ; bean, 12.1 ; barley, about 12.1 ; rice, 4.27 and 4.20; one sample gave 2.5, another, although old, only 5.7.

The use of lime water in breadmaking (method of Messrs. LAPICQUE and LEGENDRE (3) has a solvent action on the nitrogen and brings the proportion of soluble nitrogen of flours with a high bolting degree down to the normal.

The results may be summarised as follows : —

The presence of a certain percentage of soluble nitrogen in flour usually corresponds to a good absorption of water, and, consequently, to good kneading qualities of the dough, which is one of the most important qualities. The most advantageous proportion of soluble nitrogen to total nitrogen is about 16 to 17 %. If it rises or falls too much the flour will "relâche" and becomes of bad breadmaking quality. If the total nitrogen content is very high the flour is very hard to work.

The ratio of soluble nitrogen to total nitrogen, which is easily determined, can, therefore be of practical use in estimating the breadmaking qualities

(1) See *B.* May, 1913, No. 605. — (2) This term is applied to flour, usually made from badly harvested grain, which, after kneading, and when left for a time before being placed in baskets, gives out water which rises to the surface. The baker is obliged to add more flour and re-work the dough, thus obtaining less bread and a product of inferior quality. — (3) See *R.* Feb., 1918, No. 216. (*Ed.*).

of flour, not as an absolute criterion, but as a useful indication, especially when other analytical characters are lacking.

344 - **The Use of Chalk in Breadmaking.** — EFFRONT, JEAN, in the *Bulletin de la Société scientifique d'Hygiène alimentaire et d'alimentation rationnelle de l'homme*, Vol. V, No. 8, pp. 437-446. Paris, 1917.

In opposition to Messrs. LAPICQUE and LEGENDRE (1) who assert that the use of chalk inhibits the action of the soluble ferments contained in bran, which cause the acidification of bread, the author maintains that this acidity is not the result of enzyme action. The germinated grains may be treated with alkalis and acids in quantities 20 times higher than those at which enzymes in solution are destroyed without losing any of their active substances. Similarly, the soluble ferments of flour diluted in water can bear a temporary change in the reaction of the medium without any change occuring in the enzymes they contain. Sharps treated with chalk and then diluted in a mixture of flour and water keep all their active substances which, moreover, have no harmful effect on breadmaking.

The acidity of the flour, bad smell, bad keeping quality and the tendency of bread to go mouldy are not due to the enzymes of the bran, but to bacteria derived from insufficient cleaning of the grain and the presence of a large quantity of bran, the bacterial flora of which is richer than that of flour. The addition of 40 centigrams of chalk, as advocated in the new method, has no favourable action on the acidity, keeping qualities, or colour of the bread. In the presence of a fresh, strong yeast the amount of chalk advised has no action on the fermentation process. If the yeast is unsatisfactory, the introduction of chalk is certainly harmful.

Everything goes to prove that chalk bread is less easy to digest than ordinary bread, since the mono and tribasic phosphates, so favourable to salivary digestion, are replaced in the new bread by insoluble tribasic phosphates which have no influence on the very important first stage of digestion.

345 - **Tapioca Starch Made in Rhodesia.** — See No. 254 of this *Review*.

346 - **Copra Driers in Jamaica.** — WATES, L. A. in *The Journal of the Jamaica Agricultural Society*, Vol. XXI, No. 11, pp. 453-454. Kingston, Jamaica, November, 1917.

The increased production of copra in Jamaica has led to a large increase in the number of drying houses. During the last few years copra making has been carried out on a small scale on most estates, where, in nearly all the cases, it was dried on trays exposed to the sun. Today, practically every estate of any size has a drier. These driers are made on the model of that perfected by Mr. ED. ASHMAN at Boroughfield for drying cocoa. They consist of a practically air-tight wood or stone building, varying in size, containing a more or less large number of trays, heated by a furnace or stove, built in the wall. to which is attached a series of hot air pipes which

(1) See *R.* February, 1918, No. 216. (*Ed.*)

acts as a chimney or drought. A ventilator is let into the roof to regulate the heat.

Although all these driers are built more or less on the same lines, the details of their construction vary. Sometimes an ante-chamber, also practically air-tight, precedes the drying chamber. The trays are usually made of half-inch mesh wire on frames. The furnace of the best houses is so placed that the heating pipes start from about the level of the floor.

As a result of the different drying methods the quality of the copra produced also varies greatly, and often leaves much to be desired. The following technical points should be observed in drying the nuts and preparing the copra.

1) a white, pellucid copra, containing not more that 5 % moisture should be aimed at ;

2) the split nuts should be exposed in the sun for half a day or so before use ;

3) the nuts should be kept in the drier at an initial temperature of from 160 to 170° F. for at least 12 hours ;

4) suitable ventilation for removing the moisture ;

5) final desiccation at 140° F.

A uniform distribution of the heat thoughout the building, and constant and regular ventilation are essential to satisfactory drying. Since the hurricane of September, 1917, which blew down a large quantity of nuts, there has been great activity in making copra and further improvements are being made in the driers.

347 – **Wax from *Ceroxylon andicolum.*** — See No. 254 of this *Review*.

348 – **Note on the Fibre of *Wrightia annamensis.*** — CREVOST, C., in the *Bulletin économique de l'Indochine*, New Series, Year XX, pp. 487-491, figs. 2, plate 1. Hanoi-Haiphong, September-October, 1917.

Wrightia annamensis Eber. and Dub. (fam. Apocynaceae) occurs throughout Indochina ; it is commonly called " Cay Long Muc " in Cochinchina, Annam and Tonkin, and " Chhœ u dâykhla " in Cambodge.

The author quotes the description by EBERHARD and DUBARD of this little tree whose wood resembles that of box. The fibres consist of hairs forming an umbrella round the seed. These hairs are lustrous, silky, wavy and slightly drooping ; they are 3 or 4 cm. long, but there are much shorter hairs in the tuft; they taper slightly from the base towards the summit and have an average diameter of $^{5}/_{100}$ to $^{6}/_{100}$ mm. at the base, which is often reduced to $^{1}/_{100}$ mm. at the summit. The wall is as much as 3 mm. thick, but it is usually 1.5 mm. They do not consist of pure cellulose, but of lignified cellulose.

Up to the present, all spinning tests have failed. The author boiled them in a lye to which soap was added (45 litres water, 230 gm. soap, 200 gm. Phenix lye). The product was turnd slightly yellow by this bath, and unfortunately much of the natural lustre was lost. The mass of fibres thus treated and carded have the appearance of cottony down ; the fibres

are tangled, waved, shrunk in places, and are suitable for spinning on the native wheel. The thread obtained from the spindle seems fairly well conditioned, but downy; spinning is rather delicate, and the thread is not so strong as cotton. Threads twisted together in 3, 4, or 5, gave strength like wool, and resemble soft wool to the touch. They easily dye with aniline colours. When knitted, a fabric is produced having a weight like that of wool, which it closely resembles. Weaving tests are to be undertaken.

The fibres of *Wrightia* might, on account of their cellulose, be used for making explosives.

The plant appears to occur over a large area in Indochina, and it seems to grow more quickly in southern than in northern regions.

PLANT DISEASES

DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS.

GENERAL

349 - **Parasitic Fungi Collected in the Government of Podolia, Russia** (1). — GARBOWSKI, L., in the *Bulletin trimestriel de la Société mycologique de France*, Vol. XXXIII, Pt. 3 and 4, pp. 73-91, figs. 1-4. Paris, 1918.

This is a list of 121 species of micromycetes living parasitically on cereals and other plants, both cultivated and wild, collected in 1915 in various districts of the government of Podolia. Four species are mentioned as being new to science, amongst them *Fusariella Populi*, found on leaves of *Populus tremula*, and *Macrosporium somniferi*, on living leaves of *Papaver somniferum*.

350 - **Fungi of Southern China** (2). — YATES HARRY S., in *The Philippine Journal of Science* Section C, Botany, Vol. XII, No. 5, pp. 313-316. Manila, September, 1917.

This paper contains a list of fungi collected by Mr. F. D. MERRILL in Kwantung Province, in October and November, 1916. It includes : —

1) *Parodiella perisporioides* (B. and C.) Speg., on leaves of *Desmodium triflorum*, Canton (Honam Island) ;

2) *Trabutia chinense* n. sp., on leaves of *Ficus* sp., Loh Fau Mountain (Lofaushan) ;

3) *Phyllachora Coicis* P. Henn., on leaves of *Coix Lacryma-Jobi*, Canton ;

4) *Phyll. Cynodontis* (Sacc.) Niessl., on leaves of *Cynodon Dactylon*, Canton ;

5) *Phyll. orbicula* Rehm, on leaves of *Bambusa Blumeana*, Canton ;

6) *Puccinia Cynodontis* Desm., on leaves of *Cynodon Dactylon*, Canton ;

7) *Pucc. heterospora* B. and C., on leaves of *Prunus Persica*, Canton ;

8) *Uredo cantonensis* n. sp., on leaves of *Melothria indica*, Canton ;

9) *U. philippinensis* Syd., on leaves of *Cyperus* sp., Canton ;

10) *Uromyces linearis* B. and Br., on leaves of *Panicum repens*, Canton ;

11) *Ustilago Cynodontis* P. Henn., on inflorescences of *Cynodon Dactylon* Canton ;

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(1) See also *R.* Sept., 1917, No. 872. (*Ed.*)

(2) See also *B.* July, 1912, No. 1099 ; *B.* June, 1913, No. 754 ; *B.* June, 1914, No. 578. (*Ed.*)

12) *U. Koordersiana* Bref., on inflorescences of *Polygonum* sp.' Canton;

13) *Cercospora personata* (B. and C.) Ellis, on leaves of *Arachis hypogaea*, Canton; this fungus is the cause of a serious disease of the peanut n the West Indies; it has also been reported from the United States (1) and India, and is abundant on the leaves of Leguminosae in the Philippines; it is very similar to, and may be identical with *Septogloeum Arachidis* Rac., which causes a serious disease of peanuts in Java and has also been reported from Ceylon;

14) *Helminthosporium Ravenelii* Curt., on inflorescences of *Sporobolus elongatus*, Canton.

Pseudomonas Citri Hasse is also mentioned as living on leaves of *Citrus* sp. at Canton; this bacterium, the cause of Citrus canker (2) was not found in the material examined, but the general appearance of the infected areas was that caused by this well-known microorganism.

351 - **Varieties of Swede Resistant to "Finger and Toe" (*Plasmodiophora Brassicae*), in Denmark.** — See No. 282 of this *Review*.

352 - **Varieties of Flax Resistant to *Fusarium lini*, in the United States.** — See No. 283 of this *Review*.

353 - **Asparagus Resistant to Rust (*Puccinia Asparagi*), in Massachusetts, U. S. A.** — See No. 285 of this *Review*.

354 - **"Minnesota No. 1107" a Variety of Strawberry Little Resistant to Fungous Diseases, in the United States.** — See No. 298 of this *Review*.

355 - **Disease Resistant Direct Bearers; Observations in France in 1917.** — See No. 303 of this *Review*.

356 - **Chestnut Hybrids Resistant to Canker (*Endothia parasitica*) in the United States.** — See No. 286 of this *Review*.

357 - **Patents for the Control of Diseases and Pests of Plants.** — See No. 337 of this *Review*.

358 - ***Bacillus atrosepticus*, a Cause of "Blackleg" in Potato in Lancashire, England** (3). — PAINE, SYDNEY, G. in *The Journal of Agricultural Science*, Vol. VIII, Pt. 4, pp. 480-494. Cambridge, 1917.

The damage done in Great Britain by potato bacteria is not so extensive as that done in other countries of Europe, the United States, and Canada. The loss caused probably does not exceed 5 % of the whole crop of Great

(1) See also *R. May*, 1916, No. 581, and *R. May*, 1917, No. 492. (*Ed.*) — (2) See also *B. July*, 1915, No. 763 and *R. December*, 1916, No. 1337. (*Ed.*) — (3) See *B. Nov.*, 1916, p. 157. (*Ed.*)

Britain, but it may become more serious at any moment, as certain indications show.

Four or five different bacteria have been described in other countries as causing the disease of potatoes known as " Blackleg ", but the cause in England has not yet been identified. The author undertook to determine which of the various microorganisms mentioned actually exist in Great Britain. For his research he used material collected in August, 1916 in the neighbourhood of Ormskirk (Lancashire).

The experiments lead to the conclusion that the bacterium causing Blackleg in Lancashire is *Bacillus atrosepticus* (van Hall), which the author succeeded in isolating with great difficulty, and the morphological, cultural and physiological characters of which he describes in detail. Infection experiments gave positive results. This bacterium is in every way identical with that considered to cause the same disease in Ireland and described by PETHYBRIDGE and MURPHY under the name of *B. melanogenes*.

359 – **Notes on Downy Mildew of the Vine in Australia.** — CASTELLA, F. DE and BRITTLEBANK, C. C., in *The Journal of the Department of Agriculture of Victoria, Australia*, Vol. XV, Pt. II, pp. 685-700, figs. 1-2. Melbourne, November, 1917.

Till the summer of 1916-1917 Australian vineyards had not been attacked by downy mildew (*Plasmopara viticola*). The fungus had been reported, it is true, but only in an isolated case, on a private vineyard at South Yarra. The plant was uprooted and burnt and the disease was not again observed in Australia till January 31, 1917. Since then the fungus has appeared suddenly over wide areas of the north-east of Victoria.

As a rule the outbreak was slight. No damage was done and the fungus was not sufficiently in evidence, at least in any of the vineyards affected, to cause apprehension or to make spraying advisable. The origin of the 1917 outbreak is obscure, but there is no doubt that the excessive wetness of the summer was responsible for its development and spreading over so large an area.

It has been suggested, perhaps rightly so, that the grafted resistant rootlings imported from France during the last 10 years have acted as carriers. It is also possible that the fungus was introduced with dried grapes from Spain, Greece and Turkey. It is equally probable that the fungus existed in Victoria for a long time, but that, owing to climatic conditions, the white, downy efflorescence by which it is identified, was unable to manifest itself till the very wet summer of 1916-1917.

A description is given of the outward appearance of the disease, the damage it causes, the life history of the parasite and the methods of control used in Europe.

In normal summers Australian vine-growers, as those of California and the Cape, probably have little to fear from mildew, but the summer of 1917-1918 threatens to be even wetter than the preceding one. Spraying, when necessary, should prove much more efficacious in Australia than in France.

360 – **Citrus Diseases in Surinam.** — See No. 300 of this *Review*.

361 - **_Blepharospora cambivora_ n. gen. and n. sp., a Cause of " Ink Disease " in Chestnut Trees.** — PETRI, L., in *Rendiconti delle sedute della R. Accademia dei Lincei, Classe di Scienze fisiche, matematiche e naturali*, Ser. 5, Vol. XXVI, Pt. 2 pp. 297-299. Rome, 1917.

In his last report on his investigations into " ink disease " of chestnut trees the author concluded that the causal parasite was a multicellular mycelium of intercellular and intracellular reproduction which remained unicellular for a more or less prolonged period, and formed in the cambium globular and threadlike haustoria. The mycelium, although grown on the most varied media, had always remained sterile (1).

Later investigations enabled the author to cause the formation of spores the characters of which place the parasite among the Saprolegniineae (Schröter) while bringing it near to the *Pythiaceae* and the *Peronosporaceae*. While waiting to give a fuller description later, the author calls this member of a new genus and a new species *Blepharospora cambivora*.

To produce the disease artificially the mycelium was inoculated into healthy chestnut trees at the " R. Istituto superiore forestale nazionale " at Florence. Isolated trees and those in plantations near infected centres in the province of Cuneo (Mondovi) were used. Of 13 chestnut trees from 5 to 6 years old, planted and inoculated on May 26, 1916, 9 were dead or dying about two months later. The characteristic brown spots of the collar rose towards the epigeal base of the stem and descended towards the most superficial roots. In trees about 60 years old the infection spread in six months from the cambium over about $^1/_5$ of the whole circumference of the trunk.

In experiments carried out in Piedmont inoculations were made in August 1917, at the base of stems of young, strong shoots of chestnut trees of 10 to 15 years old in the Alma district of Frabosa Sottana (Mondovi), This district had not been attacked, but was next to a centre of infection. On October 2 some of the plants were examined and the infection was seen to have spread over almost half of the circumference of the stem, descending towards the collar. In some cases necrosis of the tissues was shown by a depression and brown coloration of the bark. The characters of the cambium and cortical tissues were identical with those of chestnut trees attacked by " ink disease ".

362 - **_Diaporthe taleola_, an Ascomycete Injurious to Oaks, in Switzerland.** — MOREILLON, M., in the *Journal forestier suisse*, Year LXIX, No. 1, pp. 1-3, 1 plate. Berne, January, 1918.

During the second fortnight of September, under a slight wind, oaks (*Quercus pedunculata*, *Q. sessiliflora* and *Q. pubescens*) of 50 to 150 years old, isolated in coppices, on dry, calcareous soil, not very deep-rooted, to the south-west of the Vaudois Jura (Montcherand, at an altitude of about 1 850 feet) lost several of their twigs. In some cases were counted ten branches per square yard, measuring as much as ½ inch in diameter and nearly 10 inches in length representing a premature loss of a maximum of 1 % of the twigs of the tree.

(1) See *R.* Oct., 1917, No. 973. (*Ed.*)

An examination of these twigs showed their loss to be caused by *Diaporthe taleola* Fries. Similar damage was observed by the author in the copses of Corcelles-sur-Chavornay (1 900 feet), on clay, and at Sauvabelin, near Lausanne (2 030 feet), on molasse. Isolated oaks on the Zürichberg, above the town of Zurich, were also recently found to be attacked by the same fungus. This fungus had already been reported by Dr. VON TAVEL in 1903 on the Käferberg, near Zurich, and yet earlier (1893) R. HARTIG had drawn attention to the damage done by the ascomycete to oaks of about 35 years old in Germany and in Austria.

363 – ***Chrysomyxa Abietis* in England and Scotland.** — HILEY, W. E., in the *Quarterly Journal of Forestry*, Vol. XI, No. 3, pp. 191-192. London, July, 1917.

On May 15, 1917 in a small wood of mixed trees, south of Ridsdale, Northumberland, were found two spruces badly attacked by *Chrysomyxa Abietis* (Wallr.) Ung. The two trees were growing together and were badly stunted, but this could not be attributed to the fungus as only the leaves of the preceding year were attacked. One tree of normal size also had yellow patches caused by the fungus on some of its lower branches.

The presence of this fungus had not hitherto been reported in England; it was probably introduced from Scotland, where it has been frequently observed of recent years. The first report of the appearance of the parasite came from Aberdeenshire in 1911, where it was found on the estate of Durris, in the Dee valley. Later it was again observed in the same district, and, in 1916, was recorded from Perthshire.

Infection in England probably occurred in 1916, for, though the author could find no trace of the parasite on the 1915 shoots, the two above-mentioned trees were attacked on all the 1916 twigs except those at the top

WEEDS AND PARASITIC FLOWERING PLANTS

364 – **Devil's Fig *(Solanum largiflorum)*, a New Weed in Queensland.** — WHITE, C. T. in the *Queensland Agricultural Journal*, Vol. VIII, Pt. 3, pp. 170-172. Brisbane, September, 1917.

This paper gives a botanical description of a new *Solanum* found up to the present in the Kin Kin district, Bundaberg and Childers, but doubtless growing in other districts as well. It has recently been reported as a great pest in the first of the three above-mentioned districts.

The plant was first considered to be a southern form of *S. Dallachii* from which it differs in some respects. It does not seem to agree with any of the extra-Australian species. It is commonly called "Devil's Fig" but is also known as "Chinese Fig." This latter name is undesirable as the plant is native. The aboriginal name "Koori" of the old Bundaba natives given under *Solanum Dallachii* by F. M. BAILEY (Queensland Flora, p. 1087) belongs to this new species.

If the weeds are few they may be grubbed out; repeated cutting close to the ground exhausts the vitality of the plant, but this treatm

must be persistent to succeed; a little brine or caustic soda and arsenic about the cut surface is useful. Spraying with arsenical solutions does not seem of much value and is out of the question where cattle graze, but the injection of an arsenical solution into the main root or branch should prove successful.

365 - **A Machine for Destroying Weeds.** — See N.o 334 of this *Review*.

INJURIOUS INSECTS AND OTHER LOWER ANIMALS.

366 - **Biological Observations on Some Insects in the Department of Hérault France.** — PICARD, F., in the *Bulletin de la Société entomologique de France*, No. 19, pp. 355-357. Paris, 1917.

Special mention should be made of:

Lixus iridis Ol. — This curculionid, common on aquatic umbelliferae (*Helosciadium* = *Apium*, etc.), is sometimes injurious to celery near Montpellier.

Pieris brassicae L. — Among the parasites of the large white cabbage moth should be included the ichneumon *Pimpla alternans* Grav., which undergoes metamorphosis in the larvae of the macrolepidopteron. Three specimens reared by the author emerged November 30, 1917. It should be noted that this *Pimpla* does not develop in the larva but in the winter chrysalis of *Clysia ambiguella*.

Pyrameis cardui L. — The larva of this macrolepidopteron was reared on *Parietaria officinalis*.

Charaxes jasius L. — CH. OBERTHÜR doubts the presence of this lepidopteron in Languedoc. It is sometimes, though rarely, found in Hérault wherever the strawberry tree (*Arbustus Unedo*) grows. The author found larvae of the insect on specimens of Ericaceae at the School of Agriculture of Montpellier, and has been assured by all the lepidopteron collectors he has consulted that the adult insect has been taken in the gardens of the town and in several other localities.

Carpocapsa pomonella L. — This tortrix (apple pyralis) lives at Montpellier on the fruit of *Diospyros Kaki*, *D. Lotus* and other plants of the same genus. It did great damage to the crop in 1912 and 1913, a year in which the first generation of the microlepidopteron destroyed almost all the fruit.

Agromyza abiens Zett. — This dipteron was reported by P. MARCHAL as damaging artichokes near Perpignan. The author found it at Montpellier in the same plant under the same conditions. The larvae burrow in the leaves, along the veins, longitudinal galleries with very characteristic quadrangular expansions. There are many generations and damage is done in all seasons. The larvae were particularly numerous during the winter of 1913-1914; the exceptional cold of January, 1914, killed the greater part of them. Since then, the species, although it has not disappeared entirely, has become practically harmless.

Scleroderma domesticum Latr. — In the Montpellier Botanical Gardens

this proctotrupid hymenopteron is parasitic on the coleopteron *Phlœosinus thuyae*, and the adult insect hibernates under the bark of cypress in galeries hollowed by the scolytid.

Myrmecophila acervorum Panz. — This myrmecophilous orthopteron is fairly common in the Department of Hérault. A long list of formicidae (genera *Camponotus, Formica, Lasius, Myrmica, Tetramorium, Solenopsis*) on which it may live has already been given. To the author's knowledge the gryllid has not yet been reported on members of the *Cremastogaster* genus. It is under bark, especially that of *Pinus halepensis*, in which is *Crem. scutellaris*, that this species of Myrmecophila is almost exclusively found, at least in Hérault. It is rarer under flat stones, where the author has found it with another formicid, *Pheidole pallidula*.

367 - **Life History of *Macrosiphum illinoisensis*, the Grapevine Aphis.** — BAKER, A. C., in the *Journal of Agricultural Research*, Vol. XI, No. 3, pp. 83-89, plates 8-9. Washington, October 15, 1917.

A short note on the alternation in food plants by this species was published in 1915 by BAKER and TURNER (1). The aphid was first described by SHIMER in 1866 under the name of *Aphis illinoisensis*. Later, in 1879, THOMAS described it as *Siphonophora viticola*, and it was always mentioned under the name of *vilicola* Thos., until DAVIS, when listing the aphids of Illinois in 1910, drew attention to SHIMER'S description and gave *viticola* Thos. as a synonym of *illinoisensis* Shimer.

The species is very abundant on wild grapes (*Vitis* spp.) in the more southern parts of the United States and often damages the cultivated varieties. Specimens of it have been collected in the District of Columbia, Georgia, Indiana, Maryland, Missouri, Mississippi, North Carolina, New Jersey, New York, Oklahoma, Pennsylvania, Texas and Virginia. An aphid which might belong to the same species was found on the vine at Campinas, Brazil, in September, 1898.

As there is no complete study in scientific literature of the different forms of the aphid the author considered it wise, in view of the economic importance of the insect, to record briefly the results of some of the most recent studies on it and to give a full description of the life history of the species.

368 - ***Lepidium apetalum*, the Secondary Host of *Myzus cerasi* in Ontario Canada.** — ROSS, W. A. *The Canadian Entomologist*, Vol. XLIX, No. 12, p. 434. London, December, 1917.

Among entomologists there is a difference of opinion as to whether *Myzus cerasi*. Fabr. (cherry aphis) is migratory. CROSBY considers the question undecided. SANDERSON and O'KANE state that, so far as is known the aphid has only one food plant. GILLETTE states definitely that *M. cerasi* cannot change hosts. On the other hand, QUAINTANCE and BAKER claim that the species is migratory.

(1) See *B.* Sept., 1915, No. 990. (*Ed.*)

The author's observations lead him to conclude that this aphid is partially monophagus and partially migratory. Apterous forms live throughout the season on the primary host — cherry — and alatae, born in summer, migrate and form colonies on a secondary host. In Ontario, according to the author's observations, the favourite secondary host is *Lepidium apetalum* (wild peppergrass). He collected several *M. cerasi* from this weed and succeeded repeatedly in transferring it from the cherry to peppergrass. There is no doubt that other crucifers serve as summer hosts. In insectary experiments the author successfully established colonies of *M. cerasi* on *Capsella Bursa-pastoris*, *Brassica arvensis* and *Erysimum cheiranthoides*, but the results have not yet been verified in the field.

369 - **Sweet Sorghum Varieties Resistant to the Corn Earworm, in the United States.** — See No. 279 of this *Review*.

370 - ***Perezia mesnili* n. sp., a Protozoan Parasite of the Larvae of the Large White Cabbage Moth (*Pieris brassicae*), in France.** — PAILLOT, A., in *Comptes rendus des séances de la Société de Biologie*, Vol. LXXXI, No. 2, pp. 66-68, 1 fig. Paris, 1918.

The paper describes a new microsporidium found in the larvae of *Pieris brassicae* collected in the Sathonay-Rillieux, Lyons, district. It attacks exclusively the Malpighian tubes and the silk glands of a fairly small percentage of the larvae of the macrolepidopteron. The author places this protozoan temporarily in the genus *Perezia*, but under the name of *P. mesnili* n. sp.

371 - ***Hyperecteina polyphylla* n. sp., a Dipterous. Parasite of the Injurious Coleopteron *Polyphylla fullo* in Russia.** — VILLENEUVE, J., in *Bulletin de la Société entomologique de France*, No. 17, pp. 306-309. Paris, 1917.

Mr. Z. GOLOVIANKO, of Borispol (Russia) published at Kiev, in 1916, a study, printed in Russian and illustrated with many figures, on the development of two flies, one of which, in the larval stage, is saprophagous in a lead lamellicorn beetle, *Polyphylla fullo*; the other, parasitic on the same coleopteron, lays its eggs on the stomach of the living animal.

The author, taking as basis material sent to him by Mr. GOLOVIANKO, has ascertained the saprophagous dipteron, represented by two females, to belong to the genus *Sarcophaga*; this cannot be positively stated as there were no males.

The parasitic dipteron is an undescribed species which also exists in France; it belongs to the genus *Hyperecteina* and is closely allied to *H. mesopina* Schiner, for which it has been mistaken. The author describes the insect under the name of *H. polyphyllae* n. sp. He possesses a male of this new species taken at Cape Breton (Landes) by Mr. J. DE GAULLE and has examined the two females sent by Mr. GOLOVIANKO.

372 - ***Cosmopteryx phaeogastra* n. sp. and *C. bambusae* n. sp., Microlepidoptera attacking Beans and Bamboo respectively, in India.** — MEYRICK, E., in *The Entomologist's Monthly Magazine*, Vol. LIII (3rd. Ser., Vol. III), No. 642 (No. 354), pp. 257-258. London, November, 1917.

This paper gives a morphological description of :

1) *Cosmopteryx phaeogastra* n. sp., from larvae mining blotches in leaves of beans, at Pusa,

2) *C. Bambusae* n. sp., from larvae mining blotches in the leaves of bamboo, at Pusa.

373 - **Citrus Pests in Surinam.** — See No. 300 of this *Review*.

374 - ***Rhynchites baccus*, a Coleopteron Injurious to Apples, Apricots and Plums, in Sicily.** — DE STEFANI, T., in *Nuovi Annali di Agricoltura Siciliana*, Year VI, Ser. 6, Pt. 4, pp. 178-191. Palermo, 1917.

Repeated observations made by the author during a number of years shows that very serious damage is caused in the orchards of the mountains of Renda, in the Monreale district (province of Palermo), by the curculionid *Rhynchites bacchus*, and, to a much lesser degree by other insects of the same genus, such as *Rhynch. giganteus*, *Rhynch. auratus* and *Rhynch. ruber* (1).

Rhynch. bacchus attacks apricots and plums but especially apples. During many years the harvest was completely lost, and the author observed that the whole crop of apples and plums may be destroyed in about a week.

On apples and apricots the insect lays many eggs, but, according to the author's observations, only one on plums. Having laid its egg on the plum, the insect cuts the peduncle in about the middle, thus causing the fruit which is to feed the larva to fall to the ground. In apples and apricots, however, it either cuts the peduncle partly or not at all, so that the fruit dries up on the tree, falling only during wind or the autumn rains. Damp causes the fruit to soften and decompose, enabling the larvae within to enter the soil and complete their metamorphosis there.

All the insects do not lay eggs in good time. They do not, however, die during winter, but hide in a sheltered spot where they await spring, and the attack the fruit as soon as it has set. The author has found specimens of *Rhynch. bacchus* in November, December and January.

From many dried-up apples containing larvae of this coleopteron picked from trees by the author, emerged in September two parasitic hymenoptera, *Eupelmus degeeri* and a member of the genus *Syntomaspis*, which may form a new species. The former was present more frequently than the latter, but always in limited numbers, which leads the author to believe that these natural enemies are not really of importance.

The best methods of control are to collect the fallen fruit, each day at the same time in all infested orchards, and to pick that which is attacked but is still on the tree. The larvae in this fruit should then be killed. As a means of obtaining the desired result without total loss of the product, the author advises that the infested fruit be boiled and then given as food to pigs.

(1) See *B.* Aug. 1912, No. 1240; *B.* July, 1914, No. 693. (*Ed.*)

ALFREDO RUGGERI, *gerente responsabile.*

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The Bureau assumes no responsibility with regard to the opinions and the results of experiments outlined in this *Review*.

The Editor's notes are marked (*Ed.*).